ENVIRONMENTAL ASSESSMENT
for

MILL CREEK RESTORATION PROJECT, EGLIN AIR FORCE BASE, FL

(RCS 06-256)

28 Feb 07

Prepared by: **Environmental Analysis Section**
Stewardship Branch
Environmental Management Division
96 Civil Engineer Group
96 Air Base Wing
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FINDING OF NO SIGNIFICANT IMPACT AND FINDING OF NO PRACTICABLE ALTERNATIVE FOR MILL CREEK RESTORATION EGLIN AIR FORCE BASE, FLORIDA RCS 06-256

Pursuant to the Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act (40 Code of Federal Regulations 1500-1508), and U.S. Air Force *Environmental Impact Analysis Process* (32 CFR Part 989), the 96 Civil Engineer Group, Environmental Management Division has conducted an Environmental Assessment (EA) of the probable environmental consequences of restoring portions of Mill Creek within the Falcon Golf Course at Eglin Air Force Base (AFB), Florida.

PURPOSE AND NEED

The federally endangered Okaloosa darter only occurs in six stream systems in Okaloosa and Walton Counties in northeast Florida. Its restricted range has been further reduced by habitat modification from stream impoundment, erosion, and competition with brown darters for the same habitat. Since the time of listing in 1973, several stream sections have either decreased population levels or the species is no longer found. The goal of U.S. Fish and Wildlife Service (USFWS) is to restore and protect Okaloosa darter habitat and stream ecosystems so this species may be initially down-listed and eventually delisted.

Because of the small size of Mill Creek, its location on a golf course and the urban impacts the stream receives, the USFWS identified the Okaloosa darter population within Mill Creek as the most imperiled. Declining Okaloosa darter populations in Mill Creek hamper recovery of the species. Restoration activities should result in recovery of stream habitat that historically supported Okaloosa darters. The project is thus a vital step toward the recovery of the Okaloosa darter and its removal from the federal endangered species list. Removal of the darter from the endangered species list would eliminate weeks of delay, and thousands of dollars of expense that would otherwise be spent on Section 7 consultations for future DoD test, and training missions that could occur within the darter's six water systems found on Eglin AFB.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Proposed Action is to re-design segments of Mill Creek that run through portions of the Falcon Golf Course. Eglin's Natural Resources Branch, in partnership with USFWS, Florida Fish and Wildlife Conservation Commission, and the Eglin Golf Course, would alter Falcon holes #2, 16, and 17 by removing the buried culverts, replacing them with free-flowing streams, and installing bridges to allow cart and foot traffic. Native vegetation would be planted in the resulting streambeds. The culvert at Falcon hole #14 would be replaced with a new culvert, which has a different intake and outflow points. This action is expected to take six to eight weeks to accomplish. Due to the scheduled closing of the Eagle golf course (adjacent to Falcon golf course) from March-September 2007 and darter spawning season late March through October, with a peak in April, the project should begin after late September 2007.

No-Action Alternative is to leave Mill Creek "as is." This would not improve the darter habitat, would allow continued gradual degradation of existing habitat, and would ultimately eliminate the potential for delisting.

ALTERNATIVE CONSIDERED BUT NOT EVALUATED FURTHER

There are no practicable alternatives to re-establishing the Okaloosa darter in Mill Creek other than to conform to the "Okaloosa Darter Recovery Plan" as revised in 1998, and restore all or parts of the creek to their natural condition. This is the second objective in a list of eight cited in the plan under "restore and protect habitat in the six Okaloosa darter stream watersheds." The project is a vital step to the downlisting and delisting of the species.

ENVIRONMENTAL CONSEQUENCES

No significant environmental issues or concerns have been identified for the proposed action. Additional information can be found in Section 4 of the EA, pages 8-9. The effects of the project on these issues were found to be negligible:

- Air Quality: Eglin AFB is in an air quality attainment area. While the use of heavy machinery in the course of the restoration will generate some exhaust and dust, the amount is expected to be negligible.
- Cultural Resources: No historical or cultural issues/assets exist at or in close proximity to the proposed site of the planned action. Additionally, no effects would occur on any other structures or sites eligible for listing on the National Register. Therefore, a Section 106 consultation with the state historic preservation officer is not required.
- Environmental Justice/Protection of Children: Since the action is entirely on the golf course, no minority group or low-income group would be unfairly treated or unduly burdened by implementing or not implementing the proposed action. So too, children would not be endangered as the golf course is fenced and is not normally a play area for children.
- Hazardous Materials/Waste: Under the proposed action, the old culvert material would be either recycled or disposed of into a secure, permitted facility.
- Land Use: No change in land use would occur.
- Noise: Construction would not result in more than nominal and temporary changes in the noise environment.
- Physical Resources/Soils: No unique physical features (climate, geology, topography, soils) or areas exist in the vicinity of the proposed action. Construction would take place on previously disturbed property that is relatively level.
- Safety/Restricted Access: The golf course is a fenced area so there is limited access to the project area. Further, work would be scheduled and the tee boxes moved to minimize worker/golfer conflict.
- Socioeconomics: The Eglin Golf Course presently consists of 36 holes, divided between the Eagle and Falcon courses and averages 80,000 rounds of golf per year. Impact to golfers would be minimized during construction by shutting the Falcon course on low usage days, temporarily moving tee-boxes, and scheduling work for early morning. There would be no physical effects outside the boundary of the golf course.

The following sections discuss the impacts that will occur during construction activities:

- Wetlands: Water level in the pond lying between Falcon holes #2 and 17 would be lowered, creating additional floodplain and perhaps several daughter ponds. If no ponds form spontaneously, Eglin would create some. Newly exposed soils will be vegetated with native plants.
- Floodplains: Additional floodplain along the restored creek segments would be created. The old pond beds would serve as a new floodplain, and the new channels through the fairways would be 50 to 75 feet wide, creating additional floodplain. Newly exposed surfaces would be vegetated with native plants.
- Water Quality: Temporary effects to water quality would occur. Turbidity would increase for the duration of the construction but no long term changes would occur. Best management practices, such as use of hay bales and silt curtains, would be employed during construction to minimize these temporary effects.
- Coastal Zone Management: Because this project will require a Joint Application for Works in the Water of Florida (Dredge and Fill Permit), a separate Coastal Zone Management Act (CZMA) Determination from the Florida State Clearinghouse will not be required. The issuance of the permit by the state will constitute their concurrence of Eglin's compliance with the CZMA Program.
- Biological Resources: Refer to Section 4.9 of the Biological Assessment (Attachment A of the EA) and pages 17-18 of the Biological Opinion (Attachment B). A Florida Joint Works in the Water Permit and a Generic Permit for Stormwater Discharge from Large and Small Construction Activities will be required and has been applied for. In accordance with the Endangered Species Act a formal Section 7 consultation with the USFWS has been conducted for this project and is included in Attachment A of the EA. Eglin estimates the action is 'likely to adversely affect" up to an estimated 145 darters during the restoration process, but the project has the potential to raise the darter population on the Eglin Golf Course from the present estimated 2100 to 3000, a 43% increase. Eglin agrees to comply with the measures set forth in the Biological Opinion. The project aims to reestablish segments of Mill Creek on the Eglin Falcon golf course as Okaloosa darter habit. Currently an estimated 2100 darters inhabit disjunct segments of Mill Creek totaling 1.2 kilometers on the golf course.

CUMULATIVE EFFECTS

Completion of the project would reverse some of the deleterious effects of the original construction of the southern portion of Eglin's Falcon Course that destroyed darter habitat in the 1970's. Enough habitats would be created to support an additional 890 darters. No other project is planned or budgeted for Mill Creek. Restoration work on Little Rocky Creek has been budgeted, but will not affect Mill Creek since the two creeks are not confluent. It should further increase darter habitat, improving the chance for darter delisting. AF Form 813 RCS 05-094 calls for the repair of the bulkheads on Falcon hole #9, upstream of the proposed project area. Repair would prevent catastrophic mass-wasting into the upper reaches of Mill Creek and prevent disruption of existing habitat north of College Blvd. This action is currently under Section 7 consultation.

PUBLIC NOTICE

A public notice was published in the *Northwest Florida Daily News* on 17 July 2006 inviting the public to review and comment upon the EA and Draft Finding of No Significant Impact/Finding

of No Practicable Alternative. The public comment period closed on 30 August 2006 with no comments received.

FINDING OF NO PRACTICABLE ALTERNATIVE

Taking the above information into consideration, pursuant to Executive Orders 11988, *Floodplain Management* and 11990, *Protection of Wetlands*, and the authority delegated by Secretary of the Air Force Order 791.1, I find there are no practicable alternatives to conducting the proposed action within the floodplain and wetland areas, and the proposed action includes all practicable measures to minimize harm to the environment. This finding fulfills both the requirements of the referenced Executive Orders and the Air Force *Environmental Impact Analysis Process* requirement (32 CFR 989.14) for a Finding of No Practicable Alternative.

FINDING OF NO SIGNIFICANT IMPACT

Based on my review of the facts and the environmental analysis contained in the attached EA and as summarized above, we find the proposed decision of the Air Force to restore portions of Mill Creek adjacent to the Falcon Golf Course at Eglin AFB will not have a significant impact on the human or natural environment, therefore, an environmental impact statement is not required. This analysis fulfills the requirements of the NEPA, the President's Council on Environmental Quality and Title 32 CFR Part 989, the Air Force *Environmental Impact Analysis Process*.

JEFF MUNDEY, P.E.
Deputy Command Civil Engineer
Directorate of Installations and
Mission Support

28 March 07
Date

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1.0 Purpose and Need for Action

1.1 Purpose: The 96th Civil Engineer Group, Natural Resources Branch (96 CEG/CEVSN, *aka* Jackson Guard) proposes restoring segments of Mill Creek previously reconfigured by the construction of Eglin's Falcon golf course as Okaloosa darter (*Etheostoma okaloosae*) habitat by removing culverts from three holes on Eglin's Falcon golf course and by replacing and relocating a fourth culvert. The work would preferably begin no later than early January 2007 in order to be finished before darter spawning season (March-April) and before Eglin's Eagle course is closed for renovations (March to September 2007) but could start between late September 2007 and mid-January 2008.

The endangered Okaloosa darter only occurs in six watersheds that drain into Boggy and Rocky Bayous along the north side of Choctawhatchee Bay in northwest Florida (Figures 1 & 2). Mill Creek is the smallest of these, with a drainage area of less than two square miles out of the 176 square miles total area of the six drainages. The 1998 revision of the Okaloosa Darter Recovery Plan[1] identifies the Mill Creek darter population as the most imperiled. Almost the entire length of Mill Creek flows through the Falcon and Eagle golf courses (Figure 3) on Eglin Air Force Base (AFB). The darter is well-established in Mill Creek north of College Blvd, but persists in small numbers in the remnants of free-flowing stream between the ponds and culverts that were installed to make the golf courses. One cause for these population declines may be related to losses in quality and quantity of stream habitat. The areas inhabited by the Okaloosa darter are typically the margins of flowing streams where detritus, root mats, and vegetation are present. Densities average about one darter in every 2.7 meters of stream length. Okaloosa darters have not been collected in areas where there is no current nor have they been collected in the open, sandy areas in the middle of stream channels.[1] Several reaches of Mill Creek are impounded, altering present-day channel morphology. Declining Okaloosa darter populations in Mill Creek

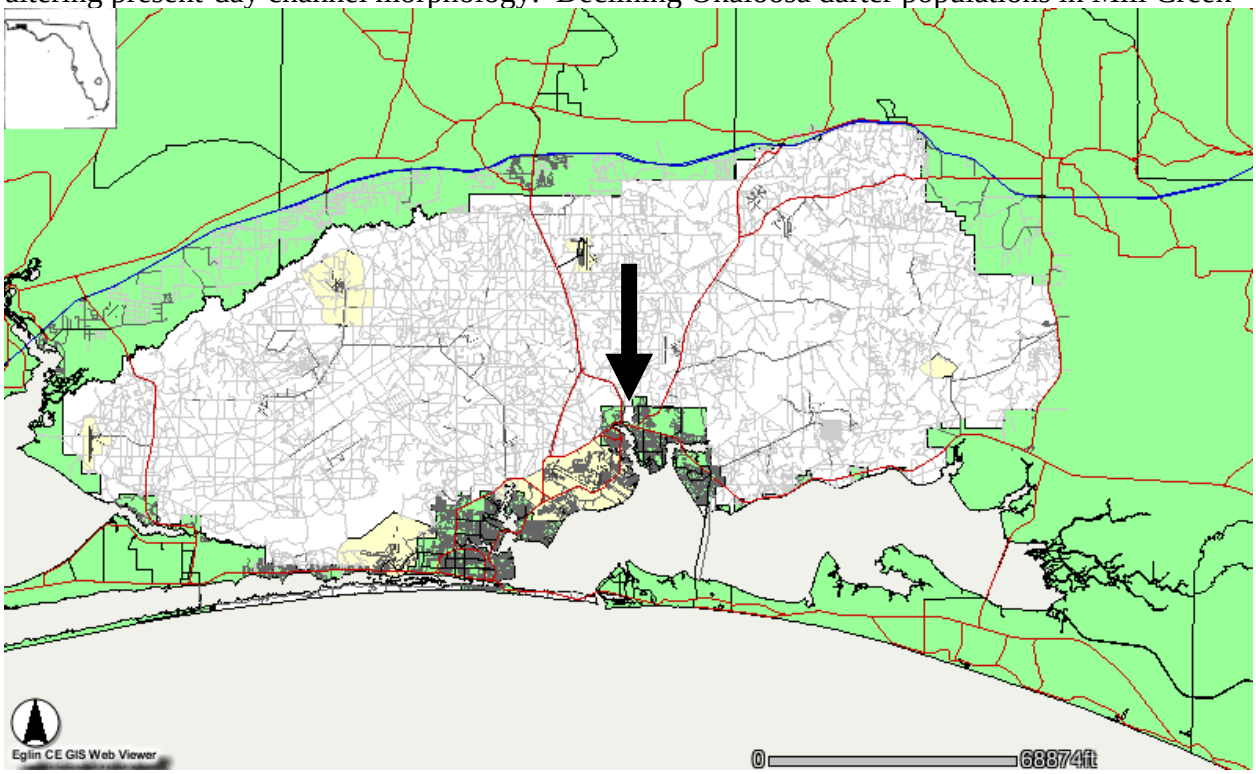

Figure 1. Eglin Reservation, area of interest indicated by arrow.

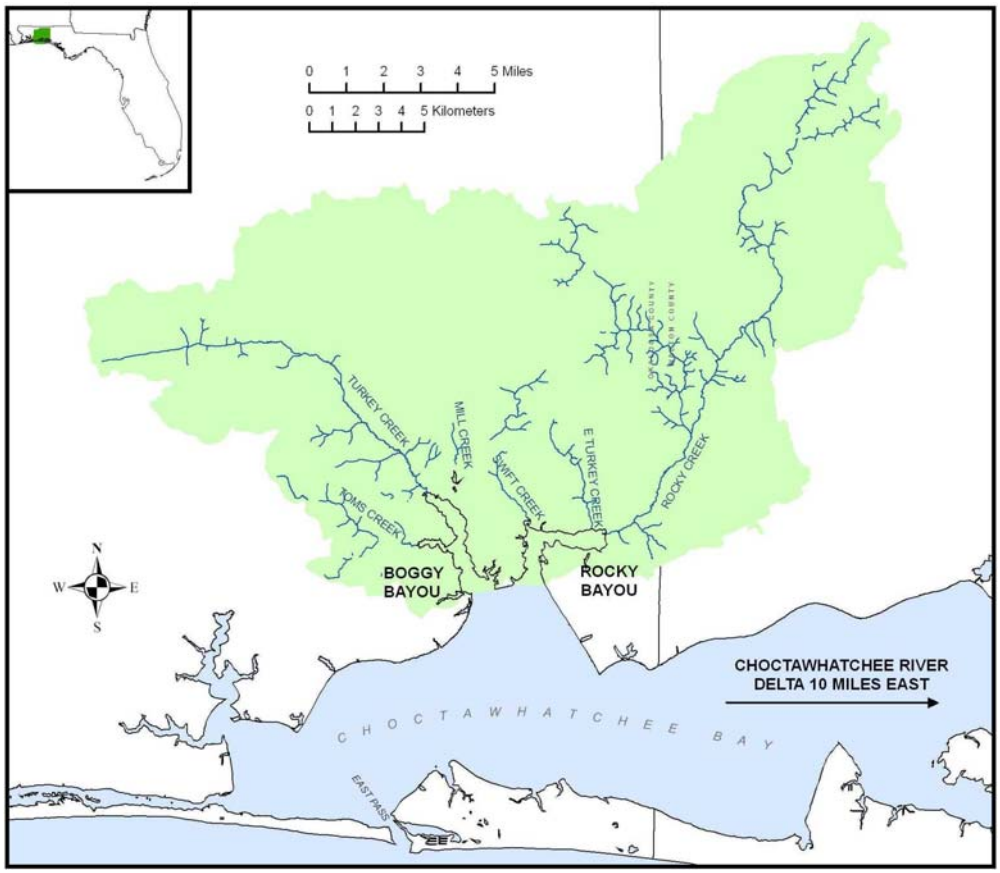

Figure 2: Range of the Endangered Okaloosa Darter

hamper recovery of the species. Restoration activities should result in recovery of stream habitat that historically supported Okaloosa darters.

The project is thus a vital step toward the recovery of the Okaloosa darter and its removal from the federal endangered species list. Removal of the darter from the endangered species list, *i.e.*, "delisting", will eliminate weeks of delay and thousands of dollars of expense that would otherwise be spent on Section 7 consultations for future test and training missions that could occur within the darter's six water systems.

Downlisting to "threatened" can occur when

- The habitat and historical flows in all six systems are protected by cooperative agreements that appear likely to remain permanent.
- Monitoring shows that the Okaloosa darter population in all six inhabited stream systems remain stable or increasing for five consecutive years

Delisting can occur when:

- Historic habitat of all six stream have been restored,
- Cooperative and enforceable agreements to protect habitat, water quality and stream slows are in effect,
- Monitoring shows the populations in all six stream systems remain stable or increasing for a 20-year hydrologic cycle.

Figure 3. Aerial Photo of Mill Creek on Eglin AFB
Red boxes show rejected alternative work areas.

The Recovery Plan is a legally binding document. Jackson Guard has budgeted $400,000 towards this project and HQ AFMC has approved these monies.

1.2 Related Environmental Documents

U.S. Fish and Wildlife Service (USFWS). "Okaloosa Darter (*Etheostoma okaloosae*) Recovery Plan (Revised)"; Atlanta, GA: 1998.

1.3 The Decision To Be Made

Whether or not to restore darter habitat along Mill Creek on the Falcon golf course in accordance with the plan set forth in the attached Biological Assessment (Attachment A) and approved in the Biological Opinion issued by the US Fish and Wildlife Service (Attachment B).

1.4 Scope Of The Environmental Assessment

The initial environmental review of this proposal by an interdisciplinary team at Eglin AFB considered the following issues:

- Air Quality
- Biological Resources
- Compliance with the Coastal Zone Management Act
- Cultural Resources
- Environmental Justice
- Foreseeable Consequences/Future Actions/Cumulative Effects
- Hazardous Materials/Waste
- Land Use
- Noise
- Physical Resources/Soils

- Safety/Restricted Access
- Socioeconomics
- Water Quality

The following issues were eliminated from detailed analysis based upon comments provided by Eglin interdisciplinary reviewers and resource managers during the review of the AF Form 813 (RCS 06-256, 20 Apr 2006).

Air Quality: Eglin AFB is in an air quality attainment area. While the use of heavy machinery in the course of the restoration will generate some exhaust and dust, the amount is expected to be negligible.

Cultural Resources: An archaeological survey of the area was conducted in 1994 in accordance with guidelines published by Florida's Division of Historical Resources. The report of findings concluded that no historic properties are located within an area encompassing the present EA's Area of Potential Effect (APE)[6]. The State Historic Preservation Officer concurred with the findings and recommendations of the report on 19 Jul 94. The methodology employed by that survey is considered adequate regarding the nature of construction impacts proposed for the present work including restoration of historic water features. In addition, it is the opinion of Eglin's staff archaeologist that the potential for the unexpected discovery of previously overlooked archaeological resources is extremely low for this APE. The SHPO and other interested parties will have the opportunity to review and comment on this draft EA during the permitting process. Should any inadvertent discoveries of archaeological material be made in the course of construction, the Eglin Cultural Resources Branch should be contacted immediately and all actions in the immediate vicinity will cease and efforts will be taken to protect the find from further impact. Such a finding would require additional consultation with the SHPO/other parties under provisions of 36 CFR § 800.13 and Eglin AFB's Integrated Cultural Resource Management Plan [7].

Environmental Justice/Protection of Children: Since the action is entirely on the golf course, no minority group or low-income group would be unfairly treated or unduly burdened by implementing or not implementing the proposed action. So too, children will not be endangered as the golf course is fenced and is not normally a play area for children.

Hazardous Materials/Waste: Under the proposed action, the old culvert material will be either recycled or disposed of into a secure, permitted facility in accordance with Air Armament Center Plan 32-7, Solid Waste Management[2]. Pesticides, herbicides, and fertilizers are regularly but sparingly used to maintain the golf course. Fertilizer and pesticide estimated usage per acre for holes affecting Mill Creek Restoration are as follows:

- Slow release fertilizer, i.e. 18-2-18 at 75 lbs per acre twice annually
- Chipco Choice® for mole crickets at a rate of 25 lbs per acre once annually
- Primo Maxx® for turf growth regulation at a rate of 11 oz per acre once annually
- Revolver® for Goose grass at a rate of 25.8 oz per acre once annually
- Revolver® for Poa Annua at a rate of 8.8 oz per acre once annually
- Weedar 64® for broadleaf weeds at a rate of 2 qt per acre once annually

These products are only applied when and where needed. For example, a hole may be 4 acres, but only 1 acre needs treatment. While these figures are strictly estimates, the Eglin Golf Course

uses as little as necessary. Since the new creekbed and floodplains won't need treatment, overall pesticide/herbicide use ought to drop slightly.

Land Use: No change in land use will occur.Noise: Construction would not result in more than nominal and temporary changes in the noise environment.

Physical Resources/Soils: No unique physical features (climate, geology, topography, soils) or areas exist in the vicinity of the proposed action. Construction will take place on a previously disturbed property that is relatively level. According to the Eglin AFB Installation Restoration Program (IRP) Management Action Plan, no known or suspected hazardous or toxic sites are present on or adjacent to the proposed construction site.

Safety/Restricted Access: The golf course is a fenced area so there is limited access to the project area. Further, work would be scheduled and the tee boxes moved to minimize worker/golfer conflict.

Socioeconomics: The Eglin Golf Course presently consists of 36 holes, divided between the Eagle and Falcon courses. The course was originally built as an 18-hole course in the 1920s, was expanded in the 1970s (before the darter was listed as endangered) to 27 holes, and was expanded again to 36 holes in the 1980s (after the darter was listed)[4]. The Eglin Golf Course averages 80,000 rounds of golf per year[5].

Although there may be some impact to golfers, this can be minimized by several measures taken alone or in concert. Monday and Tuesdays are low usage days so the Falcon course can be closed those days with all play conducted on the Eagle course. On Falcon, the tees boxes for holes #2, 14, and 17 can be temporarily moved up past the work areas (Figure 4). Work can be accomplished early in the morning before golfers would normally reach the affected holes. Falcon holes #16 & 17 could be closed for a few days when work is being done on hole #16. Any closures would be announced at least a week in advance in the *Eglin Eagle* and on flyers at the golf course.

When completed, the changes will have a negligible effect on play on holes #2, 14, and 17 as the changes are not in the usual zones of play for those holes. Not so, #16 where a new water hazard and out-of-bounds area will now cross the fairway near the approach to the green. This will add to the difficulty factor of the hole.

1.5 Required Leases & Permits:

- Joint Application for Works in the Water of Florida
- Generic Permit for Stormwater Discharge from Large and Small Construction Activities

These permits will require coordination through 96 CEG/CEVCE, Environmental Management, Compliance Branch, Engineering Section.

2.0 Description of Proposed Action and Alternatives:

Eglin's Natural Resources Branch (96 CEG/CEVSN), in partnership with the U.S. Fish and Wildlife Service (USFWS), Florida Fish and Wildlife Conservation Commission, and the Eglin Golf Course (96 SVS/SVBG), proposes to restore some of the endangered Okaloosa darter habitat that was lost during the construction of the Eglin Falcon Golf course.

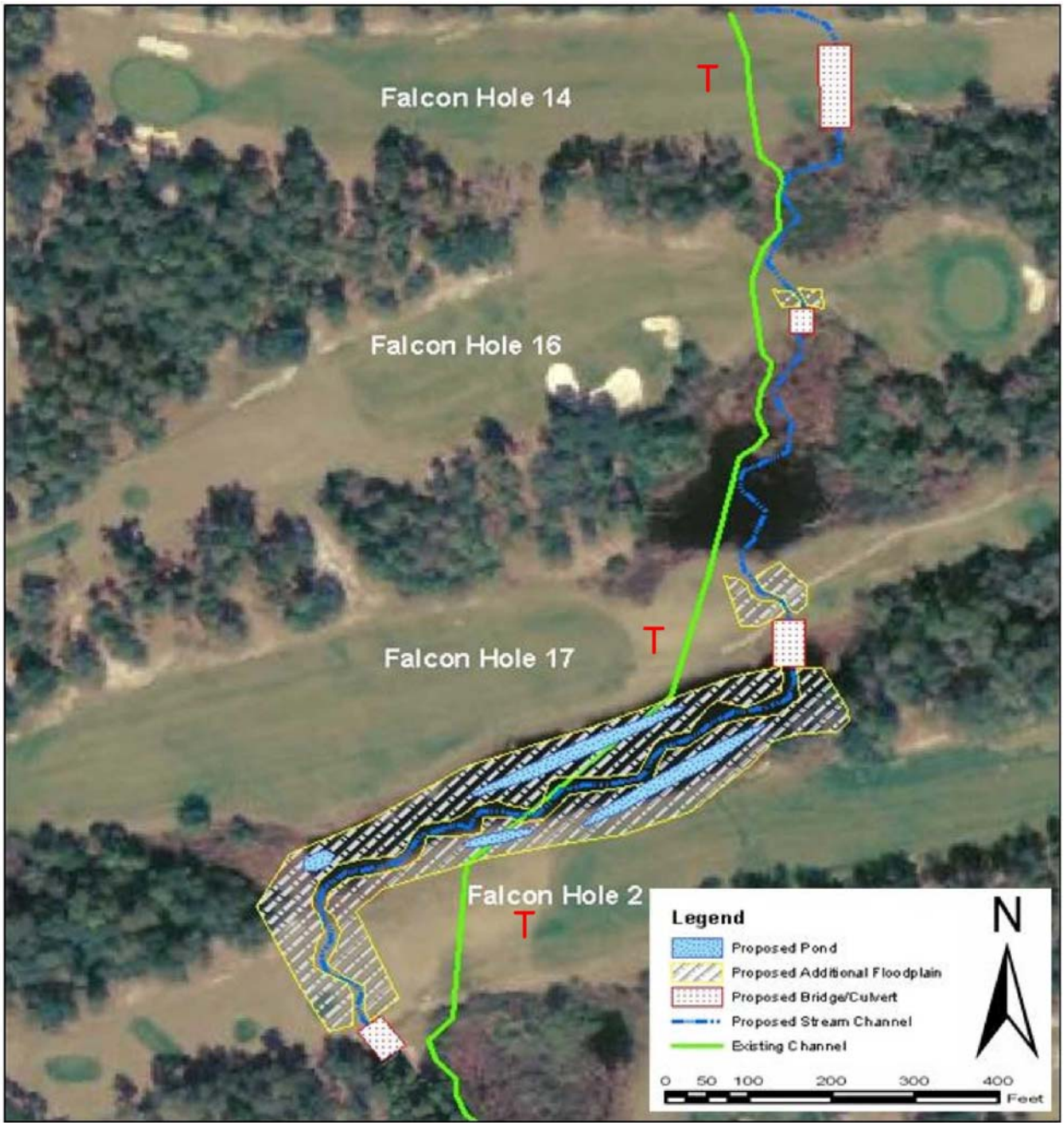

Figure 4. Proposed Mill Creek Restoration Design. Red "T" shows possible temporary tee locations.

PROPOSED ACTION is to reconfigure segments of Mill Creek that run through portions of the Falcon golf course. Buried culverts on Falcon holes #2, 16, and 17 would be removed and be replaced with free-flowing streams. Bridges would be installed to allow cart and foot traffic. Native vegetation would be planted in the recreated floodplain areas. The culvert at hole #14 would be replaced with a new culvert with different intake and outflow points. (See Figure 4). Since channel construction will require the use of heavy equipment in close proximity to the existing channel, Eglin would take the following measures to minimize siltation and impacts to darters:

- Silt fencing as deemed appropriate and in accordance with permitting requirements;
- Constructing segments from the downstream end to the upstream end
- Completing construction of the new channel (including bridges, in-stream structures, and planting native vegetation in the new floodplain) prior to routing water from the old channel to the new
- Lowering pond water level slowly to allow animals the opportunity to migrate downstream into Plew Lake

The new stream channel will be allowed to determine itself through the old pond beds; if one doesn't develop naturally, Eglin will build one. Any surviving off-channel ponding would be retained; if none survive, some isolated ponds will be constructed. The rest of the pond bed will be converted to floodplain. The project would impact approximately 85 meters of current darter habitat to establish approximately 609 meters of continuous habitat, enough for 226 darters. The action is expected to take six to eight weeks to accomplish. Due to the scheduled closing of the Eagle course from March-September 2007 and darter spawning season in March-April, the project may proceed in January and February or after late September 2007. See Attachment A for design details.

This project was selected because it addresses a recovery objective outlined in the recovery plan and complies with the Endangered Species Act and the Clean Water Act. Mill Creek is smallest and most impacted of the six darter drainages, therefore least stable and most likely to be impacted by catastrophic events or landuse changes, so offers the largest payback per dollar expended.

NO ACTION is to leave Mill Creek "as is". This would not improve the darter habitat, would allow continued gradual degradation of existing habitat, and would ultimately eliminate the potential for delisting.

ALTERNATIVES CONSIDERED BUT NOT EVALUATED FURTHER: The project, as first conceived, contained two additional segments that were eventually dropped (see Figure 2):

- A segment extending south of the present project including Eagle hole #2 and parts of Plew Lake was initially considered but was rejected due to an estimated cost of over one million dollars, unstudied effects of lowering Plew Lake by 2.5 feet, and complications arising from the presence of historic resources downstream.
- A segment connecting the northern end of the proposed project with existing habitat north of College Blvd was initially considered but was rejected due to an estimated cost of 100-200 thousand dollars (not including roadwork on College Blvd), insufficiency of current surveys, and impact to traffic. A beaver dam would've been removed and the undersized box culvert under College Blvd would have been replaced. The latter would involve temporary closure of College Blvd and diversion of traffic during construction, necessitating city, county, and state involvement. This portion of the project will be reconsidered when and if funding comes available and municipal partnerships are secured.

In addition, other darter-related projects under consideration included:

- Old Eglin Railroad crossings on Little Rocky and Turkey Creeks. The Little Rocky project is designed, permitted and scheduled for funding FY 07. No designs or survey have yet been done for Turkey Creek crossing as it will be the more expensive of the two.
- City of Niceville Wastewater Sprayfields on East Turkey Creek and Shaw Still Branch. This would involve closing and restoring sprayfields leased to the City of Niceville so would require the city's cooperation and the city's construction of a suitable alternative waste water processing system.
- Old Niceville landfill on Turkey Creek. This would involve an expensive clean up of the site and negotation with the city as to who bears the cost.
- Elimination of College Pond, Swift Creek impoundment and restoration of Swift Creek. The land is leased to Okaloosa-Walton College, so would require its cooperation.

PREFERRED ALTERNATIVE: The proposed action is the preferred alternative since it alone of all the above meets the following criteria:

- The action must be consistent with the Darter Recovery Plan.
- The action must improve existing darter habitat, restore lost habitat, or create new habitat.
- Priority should be given to the most threatened segment of the darter population.
- Cooperation or and coordination with affected city, county, and state agencies must be assured.
- The action must be affordable.

2.1 Issues:

The issues remaining after the initial Environmental Impact Analysis Process interdisciplinary team review (see Section 1.2) are: natural resources, socioeconomic, water quality, consistency with the Coastal Zone Management Act, and foreseeable consequences.

3.0 Affected Environment:

The area that would be affected by the proposed action would be portions of the Eglin AFB Golf Course.

3.1 Biological Resources: This is covered in depth in the Biological Assessment in Attachment A. In short, the project aims to reestablish segments of Mill Creek on the Eglin Falcon golf course as Okaloosa darter habitat. Currently an estimated 2100 darters inhabit disjunct segments of Mill Creek totaling 1.2 kilometers on the golf course[3].

3.2 Coastal Zone Management Act: The area under study is within the Coastal Zone of the State of Florida.

3.3 Water Quality: The current state of Mill Creek is well described in Attachment A.

3.4 Foreseeable Consequences/Cumulative Effects/Future Actions

These include:

- Okaloosa darter downlisting and eventual delisting from the federal endangered species list.

4.0 Environmental Consequences

4.1 Biological Resources:

4.1.1 The Action Alternatives: In accordance with the Endangered Species Act a formal Section 7 consultation with the US Fish and Wildlife Service has been conducted for this project and is included in Attachment A. Eglin estimates the action is "likely to adversely affect" up to an estimated 145 darters during the restoration process, but the project has the potential to raise the darter population on the Eglin Golf Course from the present estimated 2100 to 3000, a 43% increase[3]. Eglin agrees to comply with the measures set forth in the Biological Opinion (Attachment B).

4.1.2 No Action Alternative: There will be no direct effect to threatened or endangered species if the project is not executed. However, Okaloosa darter species recovery will likely be insufficient to warrant delisting. The Okaloosa darter recovery plan considers the improvement of conditions at Mill Creek as a vital step to the downlisting and eventual delisting of the species[1], making it only the third fish to be downlisted.

4.2 Coastal Zone Management Act (CZMA):

4.2.1 The Action Alternative: Because this project will require a Joint Application for Works in the Water of Florida (Dredge and Fill Permit), a separate Coastal Zone Management Act Determination from the Florida State Clearinghouse will not be required. The issuance of the permit by the state will constitute their concurrence of Eglin's compliance with the CZMA Program.

4.2.2 No Action Alternative: A CZMA determination would not be required.

4.3 Water Quality:

4.3.1 The Action Alternative: A Florida Joint Works in the Water permit, which covers dredge and fill operations for both the Corps of Engineers and the State of Florida, will be required for the project as well as a Generic Permit for Stormwater Discharge from Large and Small Construction Activities. Anticipated water-related impacts are:

- Wetlands: Water level in the pond lying between Falcon holes #2 and 17 would be lowered, creating additional floodplain and perhaps several daughter ponds. If no ponds form spontaneously, Eglin would create some. Newly exposed soils will be vegetated with native plants.
- Floodplains: Additional floodplain along the restored creek segments would be created. The old pond beds would serve as a new floodplain, and the new channels through the fairways would be 50 to 75 feet wide, creating additional floodplain. Newly exposed surfaces would be vegetated with native plants.
- Water Quality: Temporary effects to water quality would occur. Turbidity would increase for the duration of the construction but no long term changes would occur. Best management practices, such as use of hay bales and silt curtains, would be employed during construction to minimize these temporary effects.

4.3.2 No Action Alternative: There would be no effect.

4.4 Foreseeable Consequences/Cumulative Effects/Foreseeable Actions:

4.4.1 The Action Alternative: Completion of the action alternative should have two readily foreseeable consequences: the first is an increase in Okaloosa darter population in Mill Creek thus enabling the second consequence, the eventual delisting of the darter and loosening of use restrictions on other areas where it occurs, giving Eglin testers and trainers more flexibility in scheduling missions. For instance, delisting would save a mission that would impact a darter stream approximately 150 days and approximately $10,000 by eliminating the need for a formal consultation.

Completion of the project would reverse some of the deleterious effects of the original construction of the southern portion of Eglin's Falcon Course in the early 1970s.

Of all the rejected alternatives listed in Section 2.0, no other project is planned or budgeted for Mill Creek. The only budgeted project, restoration work on Little Rocky Creek, will not affect Mill Creek since the two creeks are not confluent. It should, however, further increase darter habitat and thus improve chances for darter delisting.

AF Form 813 RCS 05-094 calls for the repair of the bulkheads on Falcon hole #9, upstream of the proposed project area. Repair would prevent catastrophic mass-wasting into the upper reaches of Mill Creek and prevent disruption of existing habitat north of College Blvd. This action is currently under Section 7 consultation.

4.4.2 No Action Alternative: Darter habitat on Mill Creek would be expected to remain the same or, more likely, gradually degrade until the darter became extinct in its waters.

5.0 List of Preparers

Paul R. Bolduc, Ph.D. 96 CEG/CEVSP Physical Scientist

6.0 List of Agencies and Persons Contacted

Mr. Chris Metcalf, U.S. Fish and Wildlife Service
Mr Bob Miller, 96 CEG/CEVSN, Endangered Species Biologist
Mr Mike Nunley, 96 CEG/CEVSN
Mr William Tate, U.S. Fish and Wildlife Service
Mr Paul Wargo, 96 SVS/SVBG, Golf Course Manager

7.0 References:

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4. H.D. Sikes (96 SVS/SVB), e-mail to Mr Wargo
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ATTACHMENT A

BIOLOGICAL ASSESSMENT

EGLIN AIR FORCE BASE
Florida

U.S. FISH AND WILDLIFE SERVICE

FORMAL ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

FOR

MILL CREEK RESTORATION PROJECT,

EGLIN AIR FORCE BASE, FL

JUNE 2006

U.S. FISH AND WILDLIFE SERVICE

FORMAL ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

FOR

MILL CREEK RESTORATION PROJECT, EGLIN AIR FORCE BASE, FL

Submitted to:

Department of the Air Force
96 CEG/CEVSN
Natural Resources Section
501 DeLeon Street, Suite 101
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June 2006

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AFB	Air Force Base
D.O.	Dissolved oxygen
ESA	Endangered Species Act
NRS	Natural Resources Section
USAF	U.S. Air Force
USFWS	U.S. Fish and Wildlife Service

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1. INTRODUCTION AND BACKGROUND

1.1 PROPOSED ACTION

The U.S. Air Force (USAF) proposes to re-design portions of Mill Creek that run through the Falcon Golf Course. The re-design would consist of stream channel and floodplain restoration, culvert removal and replacement, bridge construction, and native vegetation re-establishment. The *Okaloosa Darter Recovery Plan* (USFWS, 1998) identifies the Mill Creek darter population to be the most imperiled, and considers the improvement of conditions in Mill Creek as a vital step to the downlisting and delisting of this species. Under the Proposed Action, the USAF would accomplish the following actions:

- Falcon Hole 2: Build new stream channel and floodplain, re-establish native vegetation, construct bridge structure.
- Between Falcon Hole 2 and Hole 17: Drain pond and build new stream channel.
- Falcon Hole 17: Build new stream channel and floodplain, re-establish native vegetation, construct small bridge.
- Between Falcon Hole 16 and Hole 17: Remove culvert to allow natural stream channel to re-establish, re-establish native vegetation.
- Falcon Hole 16: Build new stream channel and floodplain, re-establish native vegetation, construct small bridge.
- Falcon Hole 14: Build new stream channel, construct culvert.

1.2 BACKGROUND

On January 13, 2005, personnel from the Eglin Natural Resources Section (NRS), Eglin Air Force Base (AFB) Golf Course, and the U.S. Fish and Wildlife Service (USFWS) met to discuss alternatives for restoring Mill Creek to a naturally functioning stream channel. During a site visit on the Falcon Course, these personnel discussed potential design analyses, including limitations and constraints. The primary issues were: golf course fairway placement through the stream channel and design criteria specifications. Participants determined that much of the area was acceptable for a modified approach to design and construction.

1.3 NEED FOR THE PROPOSED ACTION

The Okaloosa darter occurs in only six watersheds that drain into Boggy and Rocky Bayous along the north side of Choctawhatchee Bay. Mill Creek is the smallest of these, with a drainage area of less than two square miles out of the 176 square miles total area of the six drainages. The Falcon and Eagle Golf Courses on Eglin border most of the length of Mill Creek. Culverts, roadfill, and in-basin retention areas on the golf courses cause backwater and lack of streamside vegetation, and filled floodplains no longer function naturally. A series of culverts that cross each fairway eliminates darter habitat and alters natural stream processes.

Darters persist in small numbers in the remnants of free-flowing stream between the ponds and culverts that Eglin installed to make the golf courses. The *Okaloosa Darter Recovery Plan* (USFWS, 1998) identifies the Mill Creek darter population to be the most imperiled, and considers the improvement of conditions in Mill Creek as a vital step to the downlisting and delisting of this species.

1.4 OBJECTIVE OF THE PROPOSED ACTION

The objective of the Mill Creek restoration project is to accomplish the following task from the *Okaloosa Darter Recovery Plan* (USFWS, 1998):

> 1.2 Improve Mill Creek habitat to increase the very low darter population remaining there. Because of the small size of this creek and the golf course and urban impacts it receives, the population of darters in Mill Creek is the most imperiled. Okaloosa darters in Mill Creek may represent robust strain that is important to the long-term survival of the species. In case of a catastrophic event, having multiple streams populated with Okaloosa darters decreases the probability of extinction.
>
> 1.2.1 Stabilize headwater banks on the golf course.
>
> 1.2.2 Remove impediments to flow such as sediment beds, beaver dams, and clogged culverts.
>
> 1.2.3 Minimize the use of pesticides, herbicides, and other contaminants on the golf course that impact Mill Creek darters by developing and implementing a chemical use plan.
>
> 1.2.4 Restore open channel stream habitat between State Routes 190 and 20 by converting underground piped and beaver ponded segments into free flowing streams.

2. DESCRIPTION OF THE PROPOSED ACTION

2.1 PROPOSED ACTION

Eglin proposes to create a stable stream configuration for Mill Creek, to re-establish and protect riparian buffers, re-establish floodplains for flood control, and remove impounded stream reaches. The restoration project will include techniques such as the application of natural channel design principles to restore and maintain stable stream geometry relationships and bioengineering techniques for areas where floodplains need to be established.

The design phase includes addressing the dimension, pattern, and profile of the restoration area, as well as setting construction goals and providing a restoration design plan for areas where activities will take place. A stream survey crew will measure cross sections and the longitudinal profile along Mill Creek to capture features present in the stream such as the deepest part of the channel, bankfull elevation, water surface slope, top of bank, and floodplain width. Appendix A provides additional detail on the design phase. Specific design plans are not yet available, but the USFWS must approve the final design plans.

The restoration project will begin downstream and work upstream. As sections are built, the old channel streamflow will be diverted into the new channel to allow completion of the sites as the project moves upstream. The project will be completed as quickly as possible; therefore, construction of the new channel, backfill of any low areas along the stream, culvert removal, and vegetating will be completed at each section as the project moves upstream. Presented below is a breakdown of projects for restoring Mill Creek.

2.1.1 Falcon Hole 2

A single culvert controls the stream channel at Falcon Hole 2, running a distance of over 100 feet (Figure 2-1). All concerned parties agreed that the best approach for restoring this area was to build the new channel within the valley near the tee box. The USFWS would design a new stream pattern based on a reference reach which would provide the appropriate channel dimension, pattern, and profile. Eglin would re-establish vegetation along the stream channel and floodplain consisting of low growing shrubs and wetland plants. Eglin and the USFWS did not discuss the width of the new floodplain, however, 50 to 75 feet should be adequate to allow natural stream processes. Additionally, Eglin would construct a bridge structure to allow golf cart access to fairway play. Eglin and the USFWS would determine the dimensions based upon project design.

Figure 2-1. Falcon Hole 2 Fairway with Culvert

2.1.2 Between Falcon Hole 2 and Hole 17

The area between Falcon Hole 2 and Hole 17 consists of a pond that was regulated in the past; however, the water control structure has rusted open, making it non-operational, and the culvert at the outlet now controls the pond elevation (Figure 2-2). The proposed design for this area would consist of draining the pond and creating a new stream channel. Eglin could use soil materials from the Mill Creek project to isolate two smaller ponds in order to create floodplain habitat and the new stream channel.

2.1.3 Falcon Hole 17

The channel crossing Falcon Hole 17 is similar to Falcon Hole 2, where the stream is contained in a culvert (Figure 2-3). The proposed channel design for this hole would be similar to Hole 2. Eglin would build the new channel in the fairway rough, below the tee box, with a small wooden bridge. Eglin would establish a new floodplain with low growing shrubs and wetland vegetation.

Figure 2-2. Pond Between Falcon Hole 2 and 17

Figure 2-3. Falcon Hole 17 at Proposed Channel Location

2.1.4 Between Falcon Hole 16 and 17

This area between Falcon Holes 16 and 17 consists of wetland type habitat which is artificially controlled by the downstream culvert for Hole 17 (Figure 2-4). Approximately 35 meters of suitable darter habitat currently exists on the north side of the wetland habitat. Once Eglin removes the culvert at Hole 17, the USFWS anticipates that a new stream channel will develop. If one does not form naturally, Eglin will build a new channel. Eglin will plant appropriate vegetation along the new stream channel.

Figure 2-4. Wetland Area Between Falcon Holes 16 and 17

2.1.5 Falcon Hole 16

The channel crossing Falcon Hole 16 is similar to Falcon Holes 2 and 17, where the entire stream is contained in a culvert (Figure 2-5). The proposed channel design for this hole would be somewhat similar to Holes 2 and 17, but with additional features. Eglin could narrow the fairway in this area to accommodate a new stream channel. Eglin would build the new channel in the low portion across the fairway, with a small wooden bridge. Eglin would establish a new floodplain with low growing shrubs and wetland vegetation.

Figure 2-5. Falcon Hole 16 with Existing Narrow Fairway

2.1.6 Falcon Hole 14

The Falcon Hole 14 site is the upper-most fairway controlling the Mill Creek stream channel (Figure 2-6). Some of the limitations to building a new stream channel in this location are field of play and fairway width. There appeared to be very little channel adjustment from up and down the fairway due to landing zone restrictions. Eglin would need to move the stream channel up the fairway as far as possible, with a majority of the stream channel in a culvert. Eglin could constrict the fairway to a minimum width which is still undetermined. Eglin would also need to reconnect the stream channel to the downstream channel which is relatively intact, stable, suitable habitat for about 35-50 meters until it changes into a wetland near Falcon Hole 16. The new stream channel would require an appropriately sized culvert. Eglin would minimize the culvert length and narrow the fairway as much as possible.

Figure 2-6. Falcon Hole 14 on Fairway

2.1.7 Summary

The Mill Creek project would benefit the Okaloosa darter without affecting the quality of golf course play. Figure 2-7 shows the general overall proposed design. As stated in the original design proposal, Eglin would use natural channel design techniques to restore Mill Creek. While approximately 85 meters of suitable darter habitat originally would be impacted, Eglin would build approximately 609 meters (2000 feet) of hydrologically connected stream channel, along with habitat structures and riparian vegetation plantings. To provide fill for floodplain creation, Eglin would construct ponds. Several bridges would allow field of play access. Once all parties agree to the Mill Creek project, survey and design would begin.

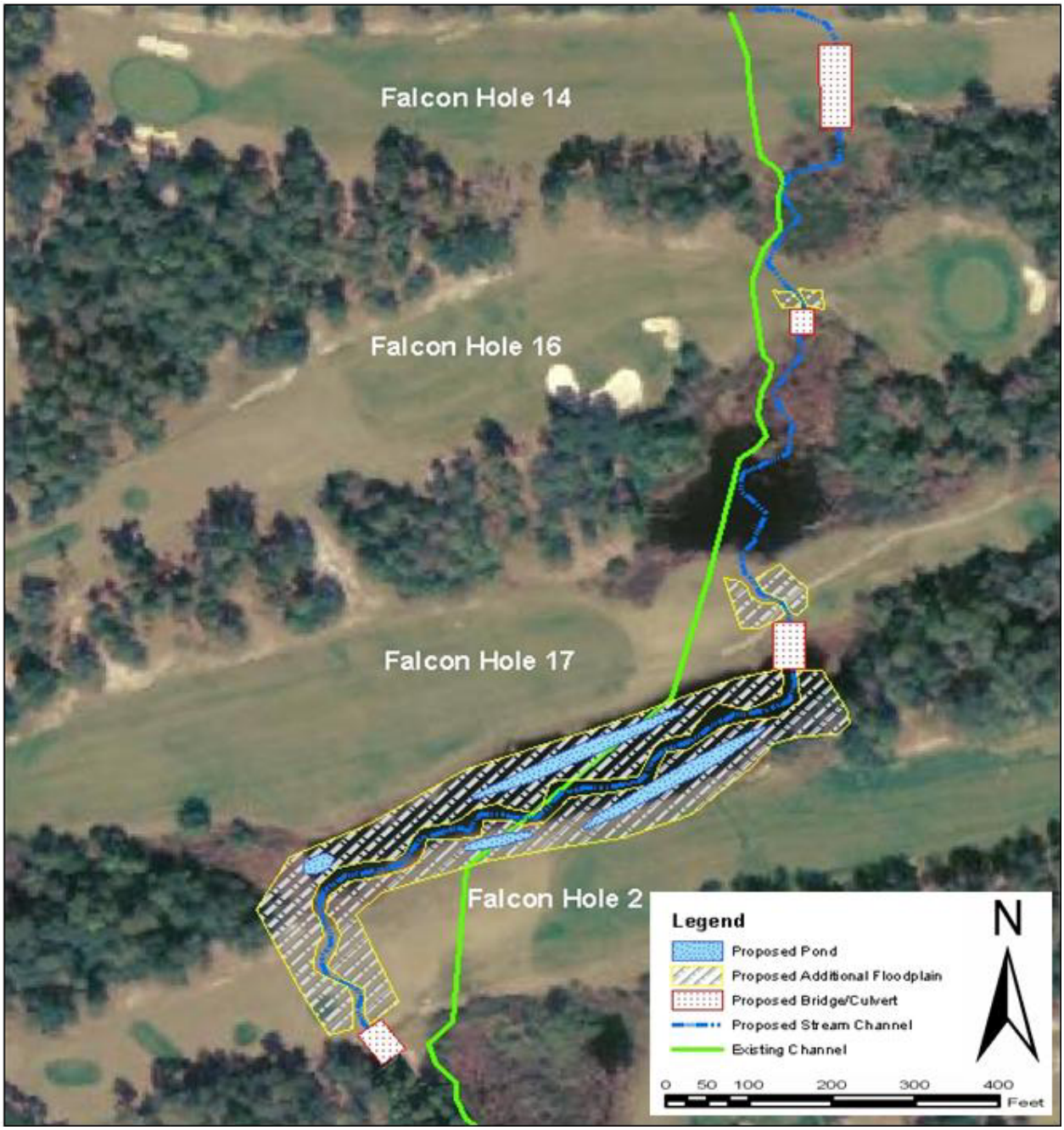

Figure 2-7. Proposed Mill Creek Restoration Design

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3. BIOLOGICAL INFORMATION

3.1 OKALOOSA DARTER

One federally listed fish species, the Okaloosa darter (*Etheostoma okaloosae*), occurs within the project area. Darter spawning occurs from March to October, with the greatest amount of activity taking place during April (USFWS, 1998). The spawning occurs in beds of clean, current-swept macrophytes (large aquatic plants). The entire global population of this species is found in the tributaries and main channels of Toms, Turkey, Mill, Swift, East Turkey, and Rocky Creeks, which drain into two bayous of Choctawhatchee Bay (Figure 3-1). These seepage streams have persistent discharge of clear, sand-filtered water through sandy channels, woody debris, and vegetation beds. Eglin AFB has management responsibility for 90 percent of the 457-square kilometer (176 square miles) drainage area. The remaining portions of the watershed are within the urban areas of Niceville and Valparaiso.

Since 1995, Okaloosa darter abundance has generally increased. During the initial years of study, population increases were mainly in the Boggy Bayou drainages, where soil erosion abatement projects were concentrated. During recent years, darter abundance has increased in Rocky Bayou drainages, which are the current focus of erosion control actions (Jordan and Jelks, 2005). The population is increasing with an average of 4.0 darters per linear meter of stream in 2005 as compared with 2.2 darters per linear meter for the previous 10 years. The overall estimate is 822,500 individuals within the 50 percent of their range that is currently sampled (Jordan and Jelks, 2005). The goal of the NRS is to have the Okaloosa darter downlisted by 2007 and delisted by 2012. At the time of this writing, the USFWS is conducting a status review for the Okaloosa darter and the NRS anticipates a recommendation for downlisting the species from endangered to threatened.

Jordan and Jelks added sites on Mill Creek in 2004 to address resource management and conservation concerns. Mill Creek is less than 5 m wide and supports an independent and isolated sub-population of Okaloosa darters. Darter abundance at these sites was lower than in the 12 core sites, but within the range of variation observed for all sites (Jordan and Jelks, 2005).

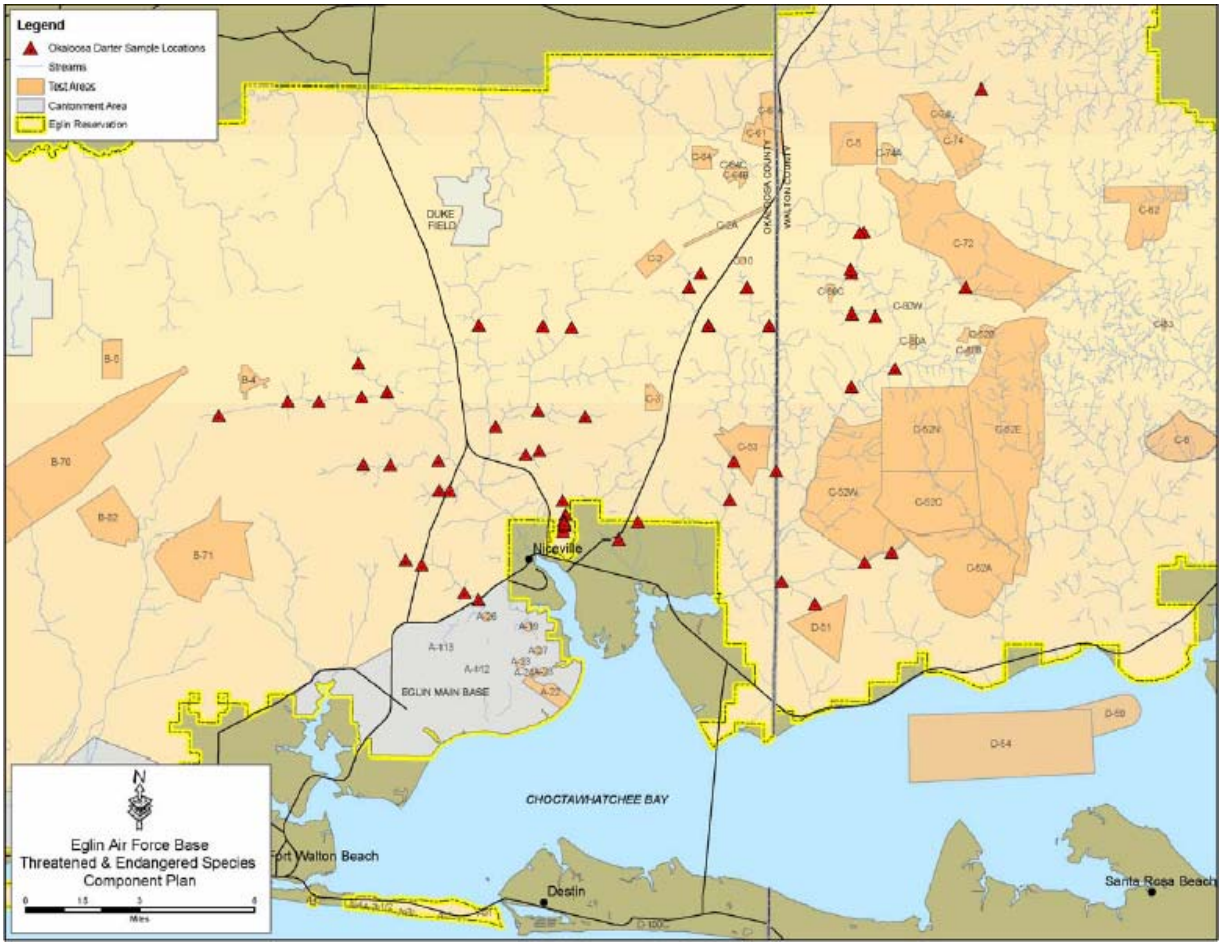

Figure 3-1. Okaloosa Darter Streams and Sampling Locations on Eglin AFB

4. DETERMINATION OF IMPACTS

The activities described under the Proposed Action have the potential to impact the Okaloosa darter. Potential negative impacts to the Okaloosa darter would be short-term, affecting 60-70 meters of suitable darter habitat, with long-term beneficial impacts once the project is completed. Stream restoration activities in and near Mill Creek are not likely to cause direct impacts to the darter; however, short-term water quality and habitat degradation and temporary blockage of fish passage may cause indirect impacts in reproductive behavior, feeding patterns, respiratory functioning, and habitat use. Sedimentation from soil disturbance in and near the stream may interfere with proper respiratory functioning, smother aquatic vegetation and woody debris that darters use as habitat, and reduce channel capacity. Loss of channel capacity leads to greater bank erosion, channel widening, increased temperatures and other alterations adverse to the darter. Eglin would incorporate avoidance and minimization measures into the proposed activities to minimize these potential impacts.

The long-term beneficial effects of the Proposed Action are the reason for this project. The new stream channel and floodplain will be substantially better Okaloosa darter habitat than the presently degraded condition of Mill Creek. The restored stream will provide more than 600 meters of improved habitat for the darter due to the return of more natural stream features and functions, such as stream-floodplain connectivity and a meandering channel that allows for increased habitat diversity.

4.1 WATER LEVEL LOWERING

Water levels would be lowered at the pond between Falcon Hole 2 and Falcon 17. Eglin would drain the pond between Falcon Hole 2 and 17, then create a new channel. Because darters prefer faster moving waters, darter numbers would likely be low in the pond. As a precaution, Eglin would lower water levels slowly to minimize the potential to strand any darters.

4.2 CULVERT REMOVAL AND INSTALLATION

Eglin would install new culverts and bridges prior to the routing of water from the old stream channel into the new channel. Eglin would use erosion control measures, such as silt fencing, as deemed appropriate in site-specific design plans and in accordance with permit requirements. After the completion of earth moving work, Eglin would backfill any low areas along the stream and plant native vegetation, which would help to minimize future erosion. Old culverts would be removed as new sections are built and stream flow is diverted into new channels.

4.3 CHANNEL CONSTRUCTION

Channel construction will require the use of heavy equipment in close proximity to the existing channel of Mill Creek. To minimize sedimentation due to equipment working in water, Eglin would complete the majority of new channel construction at each section prior to the routing of water from the old stream channel into the new channel. Eglin also would use erosion control

measures, such as silt fencing, as deemed appropriate in site-specific design plans and in accordance with permit requirements.

4.4 IN-STREAM STRUCTURES

Eglin would install all in-stream structures (J-hooks and cross vanes) prior to the transfer of water from the old channel to the new channel, thereby removing the potential for direct impacts to darters. Long-term, these structures will add habitat diversity and stability to the stream channel, having beneficial impacts on Okaloosa darters.

4.5 WATER TRANSFER FROM OLD CHANNEL TO NEW CHANNEL

As each channel section is completed, Eglin will divert Mill Creek from the old channel to the new channel. Because of the short timeframe of the project, each new section will be finished, including backfilling any low areas along the stream channel and planting vegetation, before moving upstream. Channel construction will be completed upstream of Falcon Hole 14, connecting the new channel to the natural headwaters portion of Mill Creek.

4.6 NEW FLOODPLAIN ESTABLISHMENT

The establishment of new floodplain areas at Falcon Hole 16, Falcon Hole 17, and between Falcon Holes 17 and 2, would involve soil disturbance in close proximity to Mill Creek. Eglin would minimize soil disturbance whenever possible, and would use erosion control measures, such as silt fencing, as deemed appropriate in site-specific design plans and in accordance with permit requirements. After the completion of earth moving work, Eglin would plant native vegetation, which would help to minimize future erosion.

4.7 STREAMSIDE STABILIZATION AND PLANTING

Soil disturbance from streamside stabilization and planting may lead to temporary increases in sedimentation to Okaloosa darter streams, however, long-term, this vegetation will serve to filter out sediment, nutrients, and other pollutants from reaching the stream. The vegetation will also help to stabilize the banks, provide woody debris, and provide shade which will help to maintain natural water temperatures. Long-term benefits far outweigh the short-term potential for temporary increases in sedimentation. To minimize sedimentation during the planting stage, Eglin would install silt fencing between the planting areas and the stream. Once vegetation became established, Eglin would remove the silt fencing and any sediment that had accumulated behind it.

4.8 TAKE ANALYSIS

Channel rerouting and increased sedimentation caused by soil disturbance will adversely impact about 85 meters of suitable darter habitat. Calculations of the whole Mill Creek system estimate roughly 34 darters per 20 meters of stream (Jelks, 2006). Based on these estimates, Eglin

expects a potential take of approximately 144.5 darters during the restoration process. The long-term benefits and increased potential for re-colonization of the newly constructed stream channel offset the potential losses or takes due to new channel construction.

4.9 AVOIDANCE AND MINIMIZATION MEASURES

Eglin would implement the following measures to minimize impacts.

- Employ the least intrusive methods available for completing the proposed action near Mill Creek.
- Complete the majority of new channel construction at each section prior to the routing of water from the old stream channel into the new channel.
- Use erosion control measures, such as silt fencing and silt curtains, as deemed appropriate in site-specific design plans and in accordance with permit requirements.
- Immediately after the completion of project sections, plant native vegetation along stream banks.
- Concentrate work during dry periods to limit the potential for rutting and erosion into the stream.
- Lower lake/pond water levels slowly.

4.10 SUMMARY

The Natural Resources Section believes the proposed action is **likely to adversely affect** the Okaloosa darter and its habitat temporarily, potentially impacting approximately 144.5 darters and 85 meters of suitable darter habitat. Although the channel may be initially impaired by turbidity attributed to streamside stabilization, floodplain establishment, and vegetation re-establishment, the proposed action would have long term beneficial impacts through the improvement and creation of over 609 meters of Okaloosa darter habitat. The USFWS has not designated critical habitat for this species; therefore, no impacts to critical habitat would occur.

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5. CONCLUSIONS

Based on analysis of the potential effects on the federally endangered Okaloosa darter from direct impacts, indirect impacts, and habitat impacts associated with restoration and construction activities on portions of Mill Creek that runs through the Eglin AFB Falcon Golf Course, the proposed activities are likely to adversely impact Okaloosa darters in the short-term, but will likely have long-term beneficial effects. **Avoidance and Minimization Measures** would serve to significantly mitigate potential impacts from the proposed activities.

The Air Force will notify the USFWS immediately if it modifies any of the actions considered in this Proposed Action or if additional information on listed species becomes available, as the USFWS may require a re-initiation of consultation. If impact to listed species occurs beyond what the Air Force has considered in this assessment, all operations will cease and the Air Force will notify the USFWS. Prior to commencement of activities, the Air Force will implement any modifications or conditions resulting from consultation with the USFWS.

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6. REFERENCES

Jelks, 2006. Jelks, H., 2006. Personal communication between Bill Tate (SAIC) and Mr. Howard Jelks, USGS, Gainesville, Florida. May 22.

Jordan, F., and H. Jelks, 2005. Population Monitoring of the Endangered Okaloosa Darter, 2005 Annual Report.

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APPENDIX A

USFWS MILL CREEK RESTORATION PROJECT PROPOSAL

USFWS MILL CREEK RESTORATION PROJECT PROPOSAL

Design, Construction, and Monitoring Activities Supporting Federally Endangered Okaloosa Darter (*Etheostoma okaloosae*) Recovery: Mill Creek Restoration

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Objectives

1. Assess, design, and implement stream restoration plan
2. Construct new stream channel
3. Physical, chemical, and biological monitoring pre- and post construction

Hypotheses

1. Okaloosa darters are present at sites with quality habitat
2. Construction will provide additional stream length of quality darter habitat
3. Okaloosa darter will immigrate and recruit to areas of quality habitat created by restoration activities

Justification/Need

The Okaloosa darter, *Etheostoma okaloosae*, was listed as a federally endangered species in June 1973 and has been monitored on Eglin by USGS-BRD and Loyola University New Orleans since 1995 and on private lands by Dr. Steve Bortone since 1987. Okaloosa darter populations in the Mill Creek drainage are persisting in the upper sections, but are absent from areas that are impounded. One cause for these population declines may be related to losses in quality and quantity of stream habitat. Several reaches of Mill Creek are impounded, altering present-day channel morphology. Declining Okaloosa darter populations in Mill Creek hamper recovery of this species. Restoration activities should result in recovery of stream habitat that historically supported Okaloosa darters.

Background

The entire global Okaloosa darter population exists within only six stream systems near Niceville, Florida. Nearly 90 percent of the historical range is located in the borders of Eglin Air Force Base (Eglin). The remaining 10 percent is enclosed by an urban landscape that includes housing developments, golf courses, roadways, and retail shopping malls. A recovery plan has been developed with action items that could lead to the downlisting of Okaloosa darters (USFWS, 1998). As outlined in the Okaloosa darter recovery plan, downlisting criteria are defined based on available biological information (USFWS, 1998). One of the main threats

listed in the recovery plan is degradation of habitat caused by impoundments and sediment loading. Activities associated with the reduction of sediments and removal of impoundments in darter streams on Eglin is the responsibility of natural resource managers at Jackson Guard and Civil Engineering.

Strategies used by Jackson Guard and Civil Engineering for Okaloosa darter habitat recovery include decreasing sediments entering streams and removing impoundments (either beaver or human constructed). Reductions in sediment entering the streams are the result of restoration activities in areas of borrow pits and by providing paved surfaces leading to stream crossings. One objective in the Okaloosa darter recovery plan (USFWS, 1998) is to improve stream habitat by reducing sedimentation through closure and rehabilitation of inactive borrow pits and nonpoint source sediment. Since 1994, 37 borrow pits were identified and restored. In addition, 235 nonpoint sources of sediment were identified and 156 nonpoint sources of sediment have been restored as of 2000. A total of 339 acres has been rehabilitated and maintained, with a reduction in sediment entering water bodies from these areas by 78 percent. (INRMP, 2002-2006, pp. 63-64). Most of the impoundment removal has been associated with an aggressive beaver management program which eliminates beaver presence and discourages further beaver activity. Once impoundments are removed, in many instances the natural channel is not restored which limits or delays the restoration potential at the site. Removal of the obstruction or flood plain constraint may not be enough for the stream to resume its proper form and function. Construction to recover stream morphology once impoundments are removed may be needed.

Other forms of stream impairment include culvert malfunction or placement of in-channel basin water control structures. There has been an identification of several sites along the Falcon and Eagle Golf Course on Eglin that exhibit such impacts and could be removed to benefit the Okaloosa darter.

Methods

Site Description:

Mill Creek transitions from headwaters beginning on a hilltop, at approximately 110 ft in elevation, down to a flat alluvial valley at elevation 0 ft, over a total distance of 15,200 ft. The approximate 3-mile drainage area is influenced by golf course development, water withdrawal, and stormwater runoff. A site visit through the proposed project revealed several in-basin retention areas causing backwater, lack of streamside vegetation, culverts, and roadfill. Floodplains along the golf course fairways were filled to accommodate field of play.

The stream flow regime consists of a perennial channel dominated by groundwater flow. Depositional patterns include some sidebars in flowing channel sections and high deposition features in slackwater areas caused by excessive debris and channel blockage. Channel blockages increase in size downstream with up to 100 percent affecting the active channel cross-sectional area. Five golf course fairways use culverts to divert Mill Creek into a controlled, subterranean channel.

The stream originally was connected with the valley floodplain, but now ponds exist upstream of each culvert changing fluvial dynamics from lotic to lentic conditions. These areas support many fish, wildlife, and plant fauna associated with impounded habitat. Associates of lentic systems may include largemouth bass, bluegill, mosquitofish, turtles, herons, cattails, hydrilla and other exotic invasive plants (i.e., Chinese tallow tree and privet). Existing vegetation along the stream corridor consists of deciduous trees, including native species (e.g., sweet bay magnolia, sweet gum, oaks, wax myrtle, willow) and invasive nonnative species (e.g., Chinese tallow). Shrub understory and perennial grasses were very low in density.

Assessment:

Initially, a stream assessment will be conducted to identify the magnitude of stream instability and associated departure from stable conditions. A stable stream is defined as the ability of a channel to carry the water and sediment delivered by its watershed, such that over time it maintains its dimension, pattern, and profile, while neither degrading nor aggrading. (Rosgen, 1996). The stream will be classified according to the Rosgen Stream Classification System (Rosgen, 1996). Stream classification will be determined using existing fluvial geomorphic data such as stream width/depth ratio, entrenchment, sinuosity, bankfull elevations and streambed composition. Stream cross-sections will be collected at the proposed restoration sites. Longitudinal profile information of the stream will also be included as part of the baseline data. This information will be used to design a stable stream type using natural channel design techniques that incorporates fluvial geomorphic parameters.

Restoration Design:

A. Parameters for Natural Channel

Stream disturbances in the past have been restored with a multitude of methodologies and single purpose objectives. These objectives include conducting stream bank erosion control, increasing instream fish habitat, providing energy dissipation, or containing flood flows. Traditional approaches to planning and designing stream restoration are associated with bioengineering techniques (vegetation revetment), instream habitat structures and rigid, one-dimensional channel hydraulics. These methods initially meet project objectives for improved fish habitat or reduced stream bank erosion; however, many typically lead to continued stream instability and emerging problems. The persistent tendency of stream disturbances occurs because natural self-maintaining channels are more complex with many interrelated relationships that are not taken into consideration during project planning and design. The important features to stream restoration include stream width, depth, sinuosity, meander geometry, and slope. These factors are essential components for any stream restoration project.

Successful stream restoration applies fluvial geomorphology and natural channel design techniques. This incorporates quantitative data collections along a stream section; describing the change in features laterally, longitudinally and vertically. Restoration of a stream to a habitat rich, self-maintaining and stable channel incorporates the following:

1. Accessing the watershed to determine the stream condition and unstable process;

2. Identifying an appropriate stream type for restoration based on a stream classification system associated with complex river channel form;
3. Copying an appropriate reference reach that represents a stable river section for design criteria similar to its channel form, channel materials, discharge, and fish habitat (i.e., riffle, run and pool);
4. Transposing the new channel design over the existing conditions and constructing the project.

In summary, the approach is to create a new stream channel based on an appropriate natural stable stream and replicate its physical and biological function. This stream type is typically referred to as a reference reach, or a blueprint reach that can be utilized to establish acceptable parameters for a stable channel.

Appropriate channel dimension, pattern, and profile are necessary to maintain a stable, balanced stream where the channel neither aggrades nor degrades over time. A threshold channel will be constructed to carry sediment loads and reduce near bank shear stress and bed shear stress. Streambed control structures will also be necessary to acquire rapid stream stability after construction and maintain overall channel grade. These structures will also provide instream habitat, sediment transport, velocity dissipation and minimize bank shear stress.

B. Reference Reach

A reference reach will be used to assist in designing the stream restoration project. The reference reach starts with identifying a stable stream reach near upstream or downstream from the project or within the same drainage area. This reference reach must match the new stream type being constructed. In areas where a reference reach cannot be identified, out of watershed sites may be used and only if they are located in the same hydro-physiographic region (Myers, 1990). A survey of the reference reach must be performed.

This includes measurement of stream cross sectional dimension (Figure A-1), longitudinal profile (Figure A-2), meander pattern (Figure A-3) and channel material. These data will then be converted to dimensionless ratios to allow for comparison with published values.

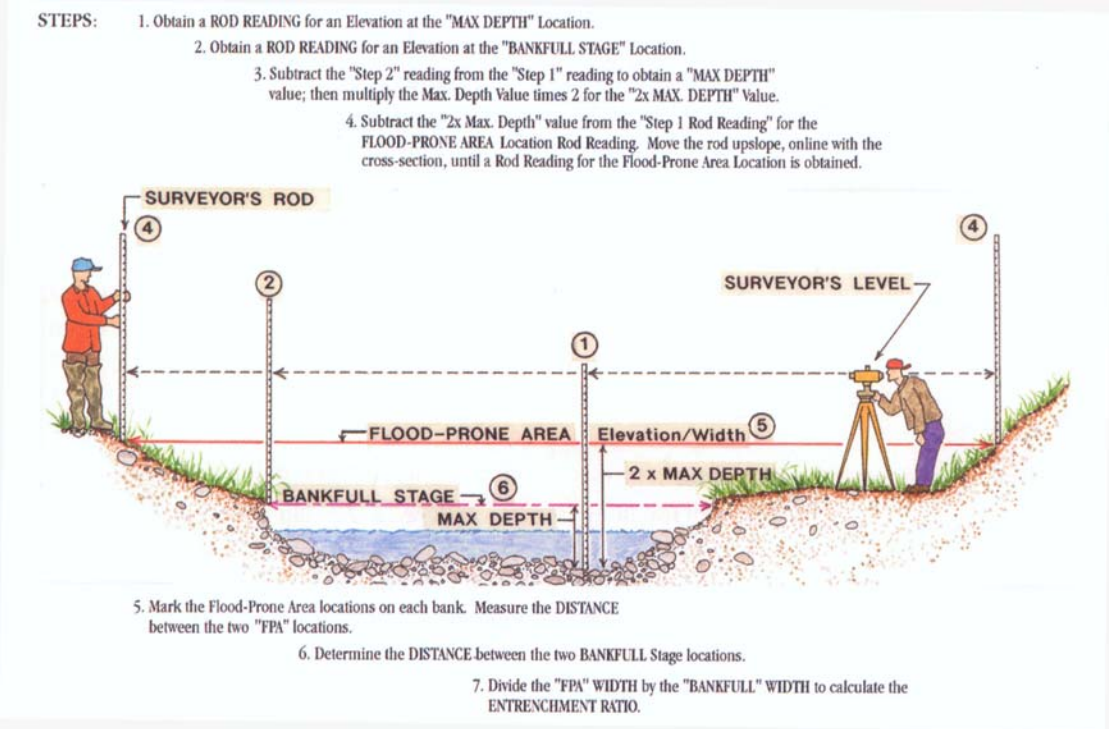

Figure A-1. Cross Sectional Survey of Stream Reach (Rosgen, 1996)

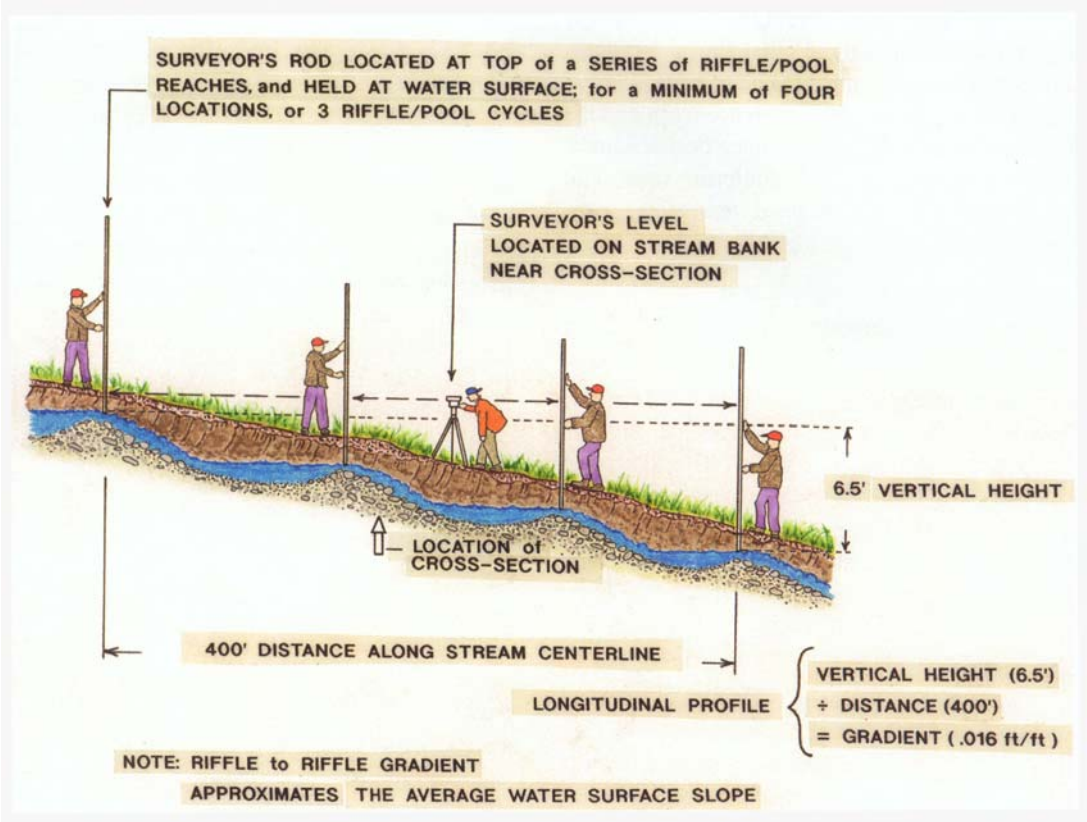

Figure A-2. Survey of Longitudinal Profile Along the Stream Reach (Rosgen, 1996)

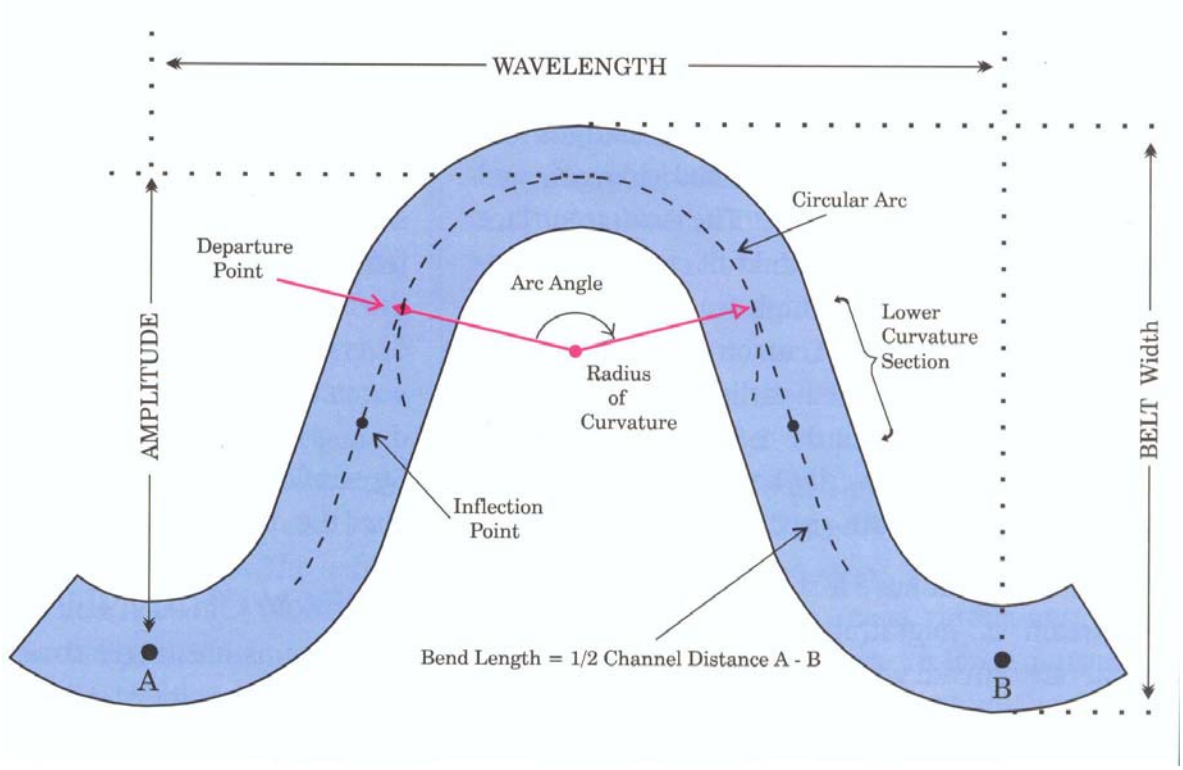

Figure A-3. Pattern Survey Along the Stream Reach (Rosgen, 1996)

The design phase includes addressing the dimension, pattern, and profile of the restoration area, as well as setting construction goals and providing a restoration design plan for areas where activities will take place. A stream survey crew will measure cross sections and the longitudinal profile along Mill Creek to capture features present in the stream such as the deepest part of the channel, bankfull elevation, water surface slope, top of bank, and floodplain width. Each station will identify existing riffles, runs, and pools.

C. Restoration Solution

This project was initiated to create a stable stream configuration for Mill Creek, to reestablish and protect riparian buffers, reestablish floodplains for flood control and remove impounded stream reaches. The focus will be on restoring habitat along the remainder of the stream channel within Falcon and Eagle Golf Course which is approximately 7,100 Linear Feet (LF), making adjustments for the altered hydrology (Figures A-4 and A-5).

The solutions to the problems identified within the watershed include a combination of techniques that will allow the use of natural channel design principals to restore and maintain stable stream geometry relationships and bioengineering techniques for areas where flood plains need to be established. Either a stable C or E stream type (Rosgen, 1996) will be constructed at the Mill Creek project. Several cross vanes and J-hook vanes will be used to maintain the stream width/depth ratio, to dissipate excess energy, maintain sediment transport, increase habitat, and maintain channel capacity (Rosgen, 2000). Meander pattern geometry will be altered to increase radius of curvature, belt width, and meander wavelength.

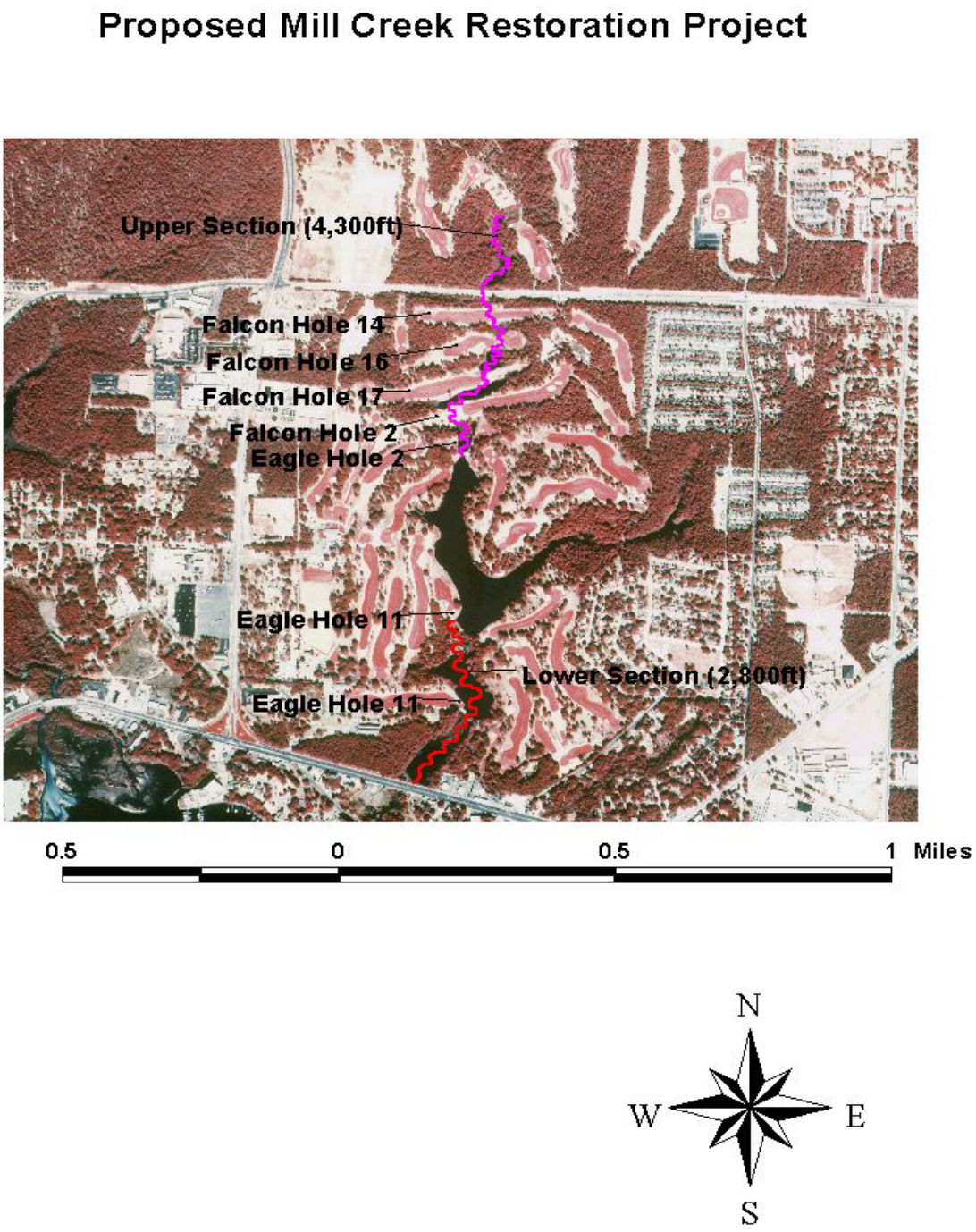

Figure A-4. Aerial Photo of Proposed Stream Restoration

Proposed Mill Creek Restoration Project

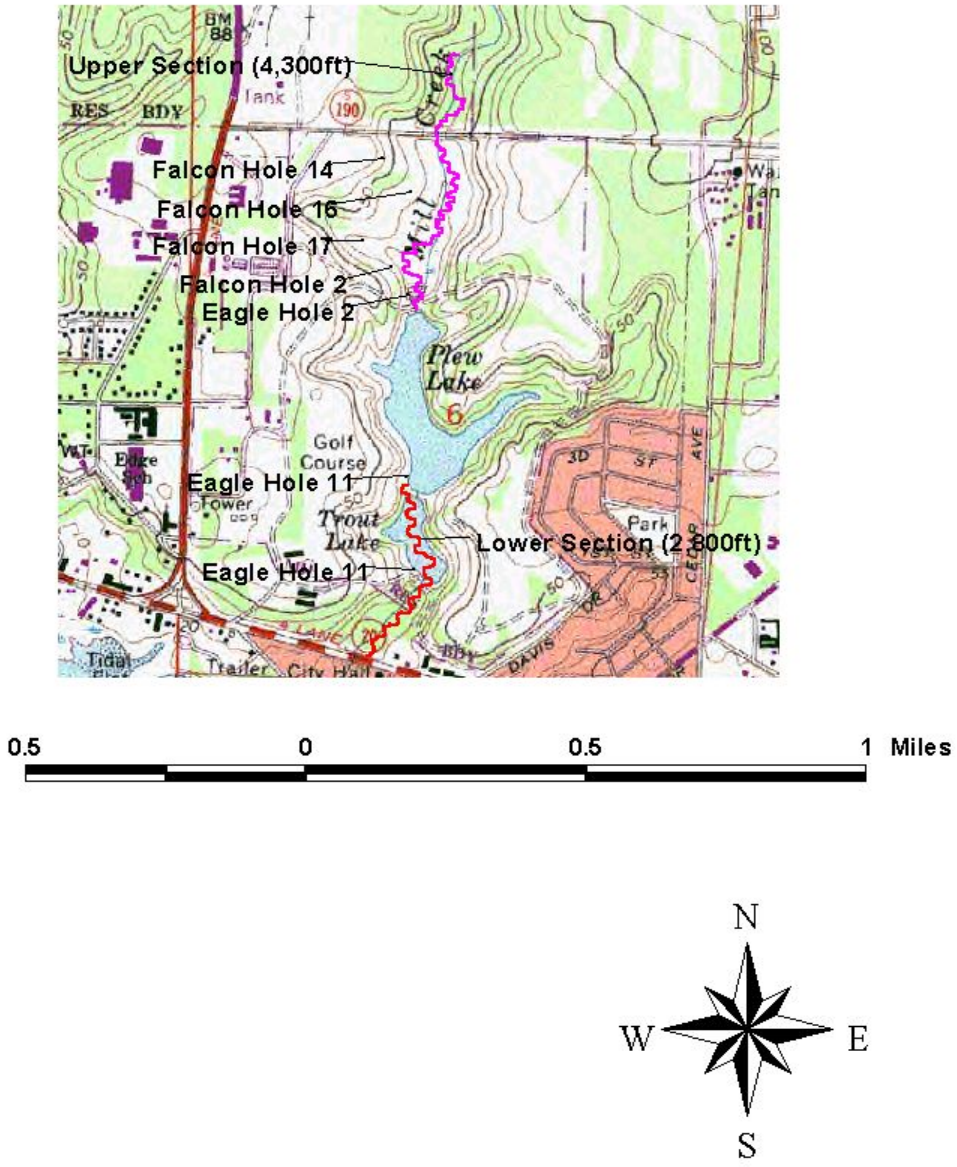

Figure A-5. Topographic Map of Proposed Project

A survey of the existing conditions along the impacted sections of Mill Creek will be completed. Measurements will include similar parameters as in the reference reach section. Once designed, existing instream structures and bridges will be incorporated into designing a new channel. This project will be considered a "Priority 1" restoration project that reestablishes a floodplain at the original level. Essentially, removal of the culverts and floodplain fill will reestablish connectivity to the floodplain and a natural stream will be constructed, with new meander geometry and mean depths. "Priority 1" restoration places bank height ratio equal to bankfull

levels, promotes vegetation growth to stabilize banks, allows channel to flood relieving channel stress during floods, maintains sediment, natural grade control and slope.

River Structures

River structures have been used to accelerate channel stability, maintain sediment transport, slope, and stream boundary. Types of in-channel structures that aid in natural channel design include cross vanes, w-weirs and j-hook vanes (Figures A-6 and A-7). J-hooks and cross vanes will be used for the Mill Creek restoration project. These structures can be made with either flat rocks or logs of various sizes and shapes (Figure A-8). In addition, rootwads will be used at the base of these structures to minimize near bank shear stress and energy dissipation (Figure A-9).

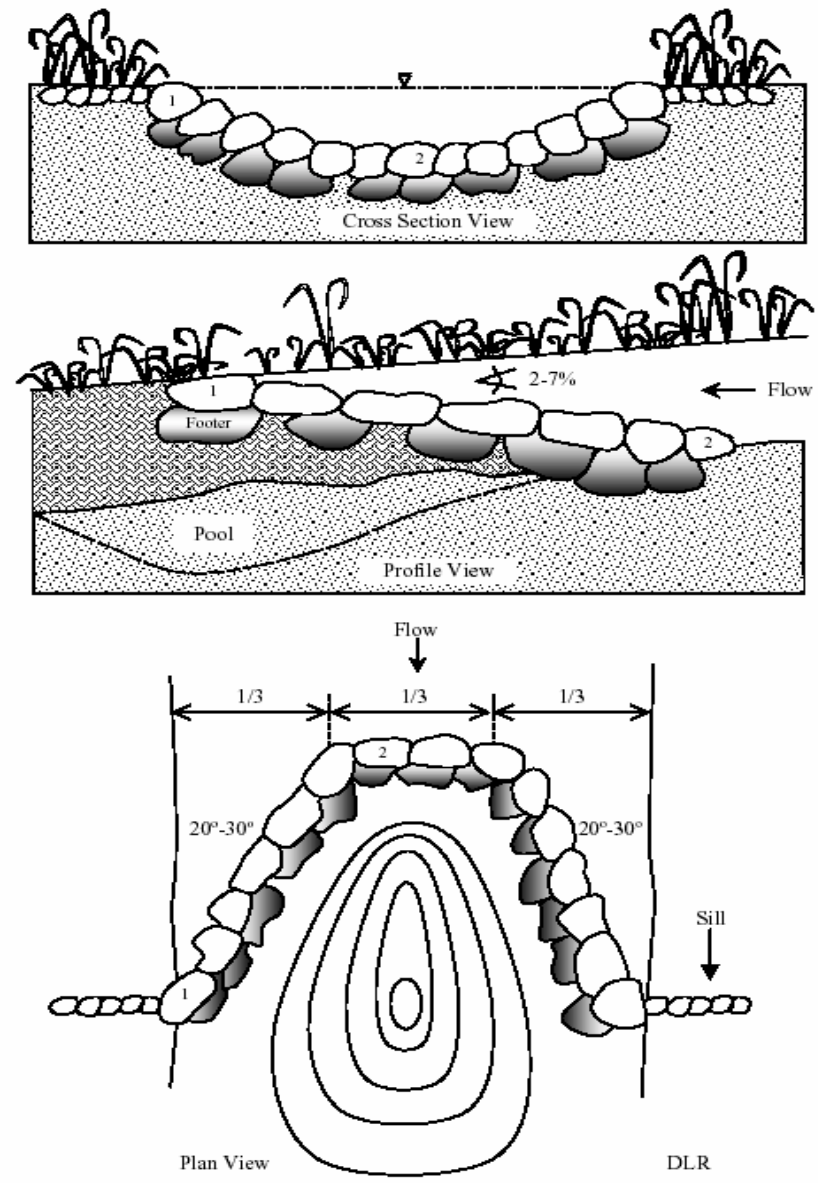

Figure A-6. Cross Vane Structure (Rosgen, 2000)

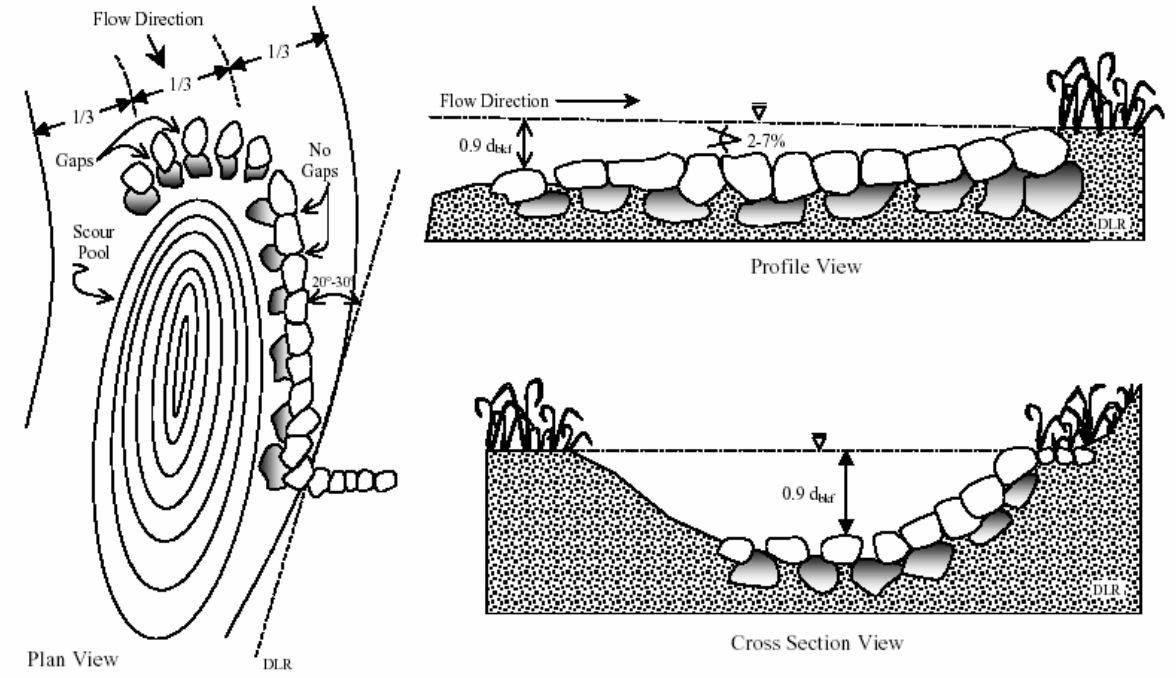

Figure A-7. J-Hook Vane Structure (Rosgen, 2000)

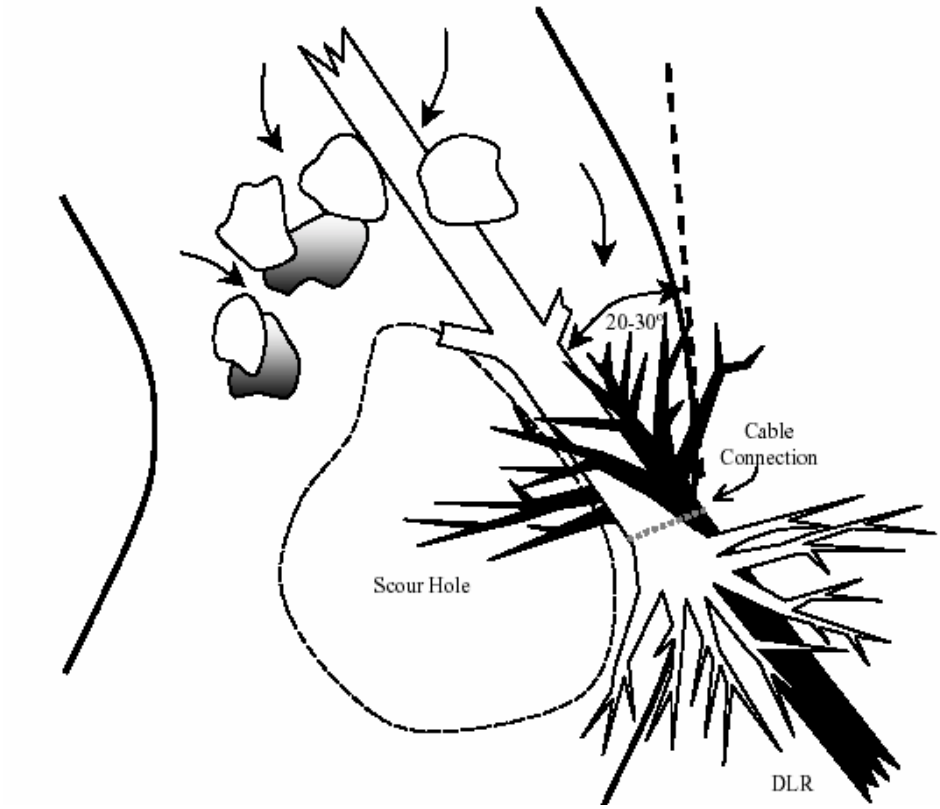

Figure A-8. Rock/Log Vane Structure (Rosgen, 2000)

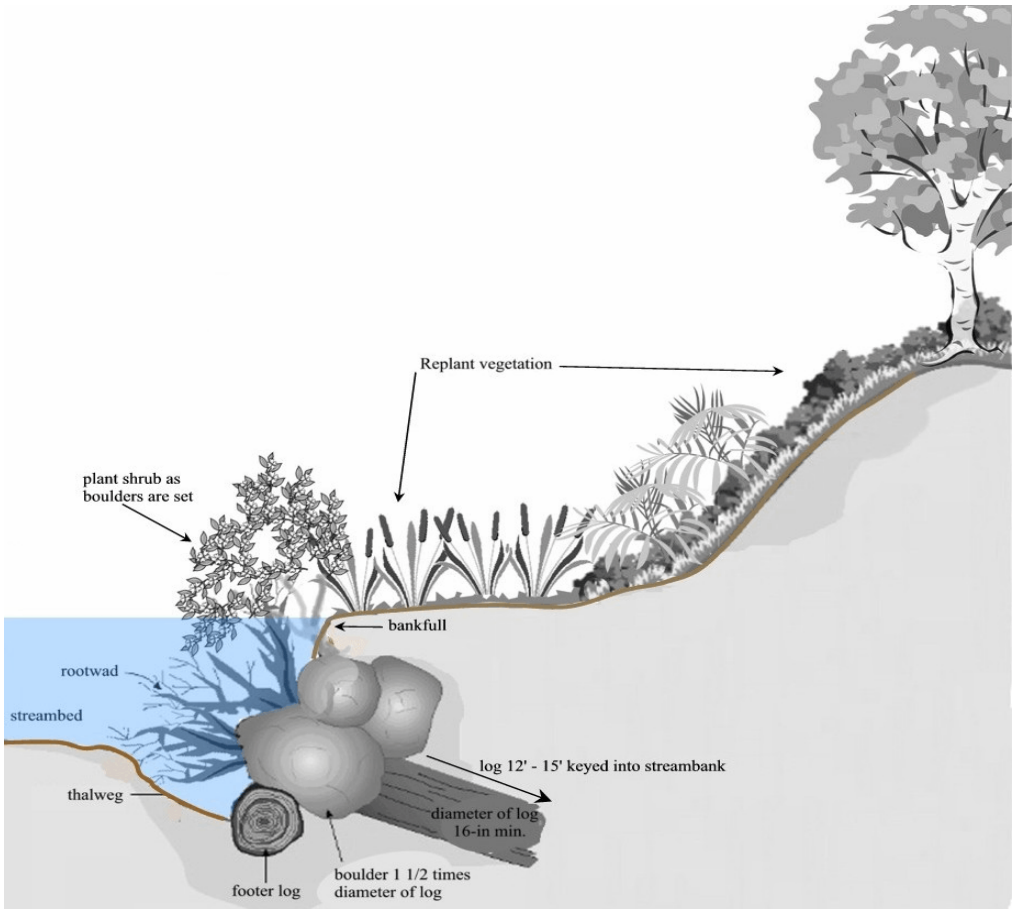

Figure A-9. Rootwad Streambank Structure

Cross vanes are mainly used for grade control, which concentrate energy, velocity, and stream power toward the center of the channel. These structures decrease near bank shear stress, erosion, and lateral stream migration. Typically, cross vanes are placed in the lower 1/3 of a river bend, maintaining glide habitat. The specific design parameters can be found in the attached report (Rosgen, 2000).

J-Hook vanes are in-channel structures that direct water velocities away from outside stream banks thereby decreasing near bank shear stress. The structure creates a velocity gradient reducing bank erosion by rolling main currents into the center of the channel, and preventing back eddy erosion. In addition, these structures provide excellent fish habitat, maintain sediment transport, and quickly stabilizes stream banks after restoration projects.

Rootwads are also used in combination with river structures and should be at least 15' long and driven into bank at the head of the structure. Rootwads should be placed at or below bankfull elevation to increase bank protection and limit any back eddy erosion.

Bioengineering

Various bioengineering techniques on the stream banks and in-stream structures will be used along the stream. Native vegetation will be planted to help stabilize stream bank soils, to help control erosion, and to improve the riparian buffer while providing habitat for wildlife species. Live fascines will be constructed [3' - 8' long, 2" - 4" wide] and placed on the outside floodplain banks and along the straight sections of the stream channel at bankfull elevation (Figure A-10).

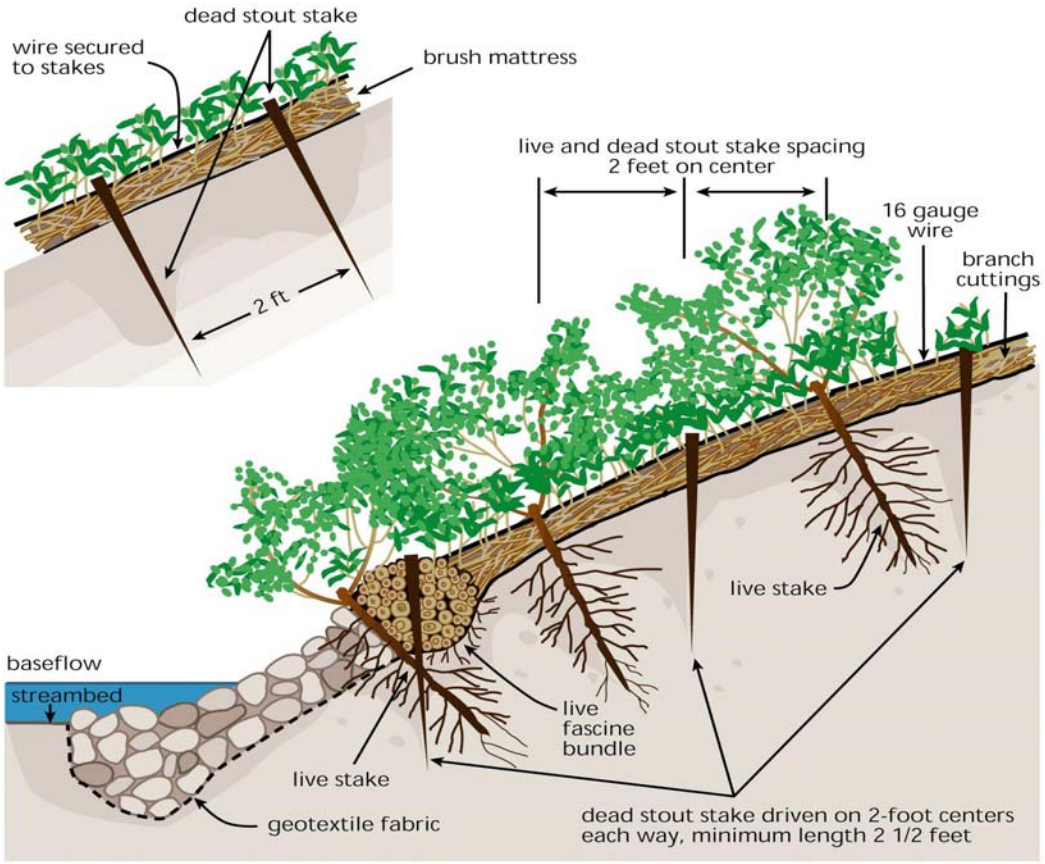

Figure A-10. Placement of Live Fascines, Willow Livestakes and Geotextile Fabric

The following plant material will be used to construct fascines:

- Hazel Alder (*Alnus serrulata*)
    - This species is not native to Okaloosa county. I would recommend either *Cornus foemina* or *Cornus alternifolia*. The latter is an endangered species that could add value to the restoration! If you need help finding material, check the Association of Florida Native Nurseries or ask me.
- Virginia Willow (*Itea virginica*)

The entire length of the stream channel will be seeded as well as all access points, immediately upon completion of the project. Either Carolina willow (*Salix carolina*) or Virginia willow (*Itea*

virginica) will be used as live willow stakes to anchor coir fiber mats on banks. The following native seed mixes will be used to establish vegetation to be used in conjunction with the coir fiber mats:

(Wet Conditions Seed Mix)

Virginia Wild Rye – 20%
Big Bluestem – 20%
Eastern Gama Grass – 30%
Switch Grass – 10%
Partridge Pea – 20%

On average, about 10 lbs/acre should be applied.

(Semi Dry Conditions Seed Mix)

Why not wiregrass, muhly grass?
Big Bluestem – 20%
Little Bluestem – 15%
Blackeyed Susan – 15%
Indian Grass – 20%
Virginia Wild Rye – 10%
Switch Grass – 5%
Showy Partridge Pea – 5%
On average, about 7.85 lbs/acres should be applied.

Riparian Buffer Zone

The riparian buffer zone will [minimum 25' each side of stream] be planted with trees and shrubs. The following trees and shrubs will be used for quick establishment and stabilization of stream banks.

Trees will be approximately 3' - 4' tall and at 8’ x 8’ spacing, with 3 rows on each side. Native tree species should include low growing trees along the fairways and larger growing trees in natural areas. Trees should consist of hazel alder, fetter-bush, sweet pepperbush, bald cypress, tupelo, black gum, tulip poplar, wax myrtle, Atlantic white cedar, and other species desirable for the location.

Shrubs should be planted at 18” – 36” shrubs spaced between trees.

Wax myrtle (*Myrica cerifera*)
Sweet Pepper Bush (*Clethra alnifolia)*
Hazel Alder (*Alnus rugosa [syn. Alnus serrulata])* [also used in live fascines]
Red Osier Dogwood (*Cornus sericea*) See Notes about other Cornus species above [also used in live fascines]

D. Monitoring Plan

Monitoring is essential to define success and progress toward success. Fish and insect communities are useful in monitoring project impacts, both positive and negative. Okaloosa darters will be monitored using the seining method (Bortone, 1998). This approach would provide presence-absence data for Okaloosa darters in Mill Creek where restoration activities are planned. If darters were not detected within 60 minutes of searching, then the site would be listed as Okaloosa darters being absent. A linear distance will also be measured at each sampling site. Rather than presence/absence, I would recommend sampling by numbers per seine set, per time, and per linear length of stream to get better values to compare. Measuring the size of fish may also give information as to whether fish are immigrating or young-of-year settling into created habitat. Additionally, fish and insect communities will be sampled to provide status prior to construction and after construction. Fish will be collected from targeted microhabitat.

Individuals will be measured, weighed, and any signs of disease, erosion of fins, lesions, tumors or sores (DELTS) will be identified. In addition to biological samples, habitat and water chemistry will be measured. Pre-construction sampling will take place prior to sampling. Monitoring the site will take place at three months and one year post-construction. There will be color photographs taken from permanent photo-points. Permanent photo-points will be established during the initial stream assessment; photos will be updated yearly as part of the annual monitoring schedule. Iron pins will be secured at each site to monitor channel stability. This includes monitoring cross sections and longitudinal profiles. Physical monitoring will occur at 3 months and 1 year post-construction.

Proposed Timeline

Design Phase will take three people 40 hrs of field labor. Data interpretation will take 18 hrs in office. CAD operator will take 60 hrs to develop conceptual stream channel design and surrounding fairway play. Rough drafting and corrections will take 40 hrs. Total Design Phase = 158 hrs.

Construction Phase will take approximately 2 months. Total cost would be approximately as follows:

- Upper section - 4,300ft @ $80/linear foot = $344,000
- Lower section - 2,800 ft @ $80/linear foot = $224,000

Monitoring Phase I (Pre-construction) will take 100 hrs. Prior to construction taking place, biologists will survey the areas immediately upstream and downstream of impoundments. These surveys will include habitat (stream width, depth, canopy cover, and substrate), water chemistry (turbidity, pH, D.O., temperature, conductivity), and biological measures. The ten area samples will provide baseline data to gauge construction success.

Monitoring Phase II (Post-construction) will take 200 hrs. Sampling 100 hours at 3 months and 100 hours at 1 year after project completion. The same methods will be used.

Products: Project will result in on-the-ground recovery of 1 to 2 miles of stream, which historically supported the Okaloosa darter and fish community associates. In addition, scientific presentations and publications will be completed within two years of project to disseminate information to peers and the general public that promote the success of restoration for recovery actions. Okaloosa darter monitoring data will be integrated into the existing Okaloosa darter database at Jackson Guard. Other fish and habitat data will be integrated into stream assessment database at Jackson Guard.

Literature Cited:

Bortone, S.A. 1998. Monitoring and sampling of Okaloosa darters at 18 sites in Okaloosa and Walton Counties. A report to the U.S. Geological Survey. Gainesville, Florida.

Myers, R.L. and J.J. Ewel. 1990. Ecosystems of Florida, University of Central Florida Press, Orlando, Florida, 765 p.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

Rosgen, D. 2000. P.H., The Cross-Vane, W-Weir and J-Hook Vane Structures (Their Description, Design and Application for Stream Stabilization and River Restoration).

U.S. Fish and Wildlife Service. 1998. Okaloosa Darter (Etheostoma okaloosae) Recovery Plan (Revised). Atlanta Georgia. 42 pp.

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ATTACHMENT B

BIOLOGICAL OPINION

Falcon Golf Course
Mill Creek Stream Restoration
Eglin Air Force Base
Okaloosa County, Florida

Biological Opinion
October 16, 2006

Prepared by:
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, FL

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United States Department of the Interior

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October 16, 2006

Mr. Stephen M. Seiber
Chief, Natural Resources Branch
96th CEG/CEVSN
501 DeLeon Street, Suite 101
Eglin Air Force Base, Florida 32542-5133

Re: FWS Log No. 4-P-06-199
Agency: Eglin Air Force Base
Project Title: Falcon Golf Course, Mill Creek Stream Restoration
Location: Eglin AFB, FL
Ecosystem: NE Gulf
County: Okaloosa County, FL

Dear Mr. Seiber:

This letter transmits the Fish and Wildlife Service's (Service) biological opinion (BO) for actions to be taken during a stream restoration project, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) Your letter dated June 14, 2006, requesting formal consultation was received on June 15, 2006. Our BO is based on information provided in the biological assessment (BA) that accompanied your letter, Service investigations in the project area, discussions with experts in the field, and other sources of information. A complete administrative record of this consultation is on file at the Service's Panama City, Florida field office.

Your BA addressed potential impacts to the Okaloosa darter (*Etheostoma okaloosae*), a species listed as endangered. No other species protected under the ESA are known to occur in the immediate project area.

CONSULTATION HISTORY

July 2003	USFWS completes draft project description.
May 2005	Eglin indicates willingness to initiate project.
June 14, 2006	Eglin requests initiation of formal consultation.
June 14, 2006	Eglin Natural Resources Branch (NRB) provides the Service with a Biological Assessment (FWS No. 4-P-06-199).
June 21, 2006	Service acknowledges initiation of formal consultation.
September 14, 2006	Draft BO sent to Eglin.
September 25, 2006	Eglin AFB provided comment on the draft BO; however, no changes were recommended.
October 16, 2006	Final BO sent to Eglin.

BIOLOGICAL OPINION

DESCRIPTION OF ACTION

The Okaloosa darter occurs in only six watersheds that drain into Boggy and Rocky Bayous along the north side of Choctawhatchee Bay. Mill Creek is the smallest of these, with a drainage area of less than two square miles out of the 176 square-mile total area of the six drainages. The Falcon and Eagle Golf Courses on Eglin border most of the length of Mill Creek. Culverts, roadfill, and in-basin retention areas on the golf courses cause backwater and lack of streamside vegetation, and filled floodplains no longer function naturally. A series of culverts that cross each fairway eliminates darter habitat and alters natural stream processes. Darters persist in small numbers in the remnants of free-flowing stream between the ponds and culverts that Eglin installed to make the golf courses (Figure 1). The *Okaloosa Darter Recovery Plan* (USFWS 1998) identifies the Mill Creek darter population to be the most imperiled, and considers the improvement of conditions in Mill Creek as a vital step to the downlisting and delisting of this species. Restoration of the lower and middle sections of Mill Creek will create new habitat for Okaloosa darters, increase the subpopulation size, and insulate against negative impacts elsewhere in the Mill Creek watershed.

The objective of the Mill Creek restoration project is to partially accomplish the following recovery objective outlined in the *Okaloosa Darter Recovery Plan* (USFWS 1998):

1.2 Improve Mill Creek habitat to increase the very low darter population remaining there. Because of the small size of this creek and the golf course and urban impacts it receives, the population of darters in Mill Creek is the most imperiled. Okaloosa darters in Mill Creek may represent a robust strain that is important to the long-term survival of the species. In case of a catastrophic event, having multiple streams populated with Okaloosa darters decreases the probability of extinction.

1.2.1 Stabilize headwater banks on the golf course.

1.2.2 Remove impediments to flow such as sediment beds, beaver dams, and clogged culverts.

1.2.3 Minimize the use of pesticides, herbicides, and other contaminants on the golf course that impact Mill Creek darters by developing and implementing a chemical use plan.

1.2.4 Restore open channel stream habitat between State Routes (SR) 190 and 20 by converting underground piped and beaver ponded segments into free flowing streams.

Eglin proposes to create a stable stream configuration for Mill Creek, re-establish and protect riparian buffers, re-establish floodplains for flood control, and remove impounded stream reaches (Figure 1). The restoration project will include the application of natural channel design principles to restore and maintain stable stream geometry relationships and bioengineering techniques for areas where floodplains need to be established. A complete description of the proposed project is provided in the Eglin NRB Biological Assessment (2006); however, the actions proposed by Eglin are summarized below:

- Falcon Hole 2: Build a new stream channel and floodplain, re-establish native vegetation, and construct a bridge structure.
- Between Falcon Hole 2 and Hole 17: Drain the pond, build a new stream channel, and construct isolated ponds in the existing pond bed.
- Falcon Hole 17: Build a new stream channel and floodplain, re-establish native vegetation, and construct a small bridge.
- Between Falcon Hole 16 and Hole 17: Remove the culvert to allow the natural stream channel to re-establish, and re-establish native vegetation.
- Falcon Hole 16: Build a new stream channel and floodplain, re-establish native vegetation, and construct a small bridge.
- Falcon Hole 14: Build a new stream channel and construct a culvert.

Action Area

The Service has described the Action Area to include all areas which would be affected directly or indirectly by the proposed action and not merely the immediate area involved in the actions as indicated in the general project location for this project (Figure 1). The Action Area for this biological opinion is described as the entire Mill Creek watershed. Mill Creek transitions from headwaters beginning on a hilltop, at approximately 35 meters in elevation, down to a flat alluvial valley at elevation 0 m, over a total distance of 3 river kilometers (rkm). The entire watershed is influenced by golf course development, water withdrawal, and stormwater runoff. The action proposed by Eglin will restore approximately one third (1 km) of the Mill Creek system, creating stream habitat between rkm 0.7 and 1.7. This constitutes a significant portion of the Mill Creek system and the proposed action will likely impact the hydrology and water quality of the system by eliminating restrictions to stream flow. Okaloosa darter population densities throughout the system may be reduced as fish colonize the newly created habitat. However, the re-establishment of stream habitat and floodplain buffers on the Falcon golf course will likely have long-term beneficial effects and increase the stability of the smallest Okaloosa darter subpopulation.

Conservation Measures

Conservation measures are actions to benefit or promote the recovery of a listed species that are included by the Federal agency as an integral part of the proposed action. These actions will be taken by the Federal agency or applicant and serve to minimize or compensate for project effects on the listed species. The BA states that Eglin will implement the following avoidance and minimization measures to minimize impacts:

- Employ the least intrusive methods available for completing the proposed action near Mill Creek;
- Complete the majority of new channel construction at each section prior to the routing of water from the old stream channel into the new channel;
- Use erosion control measures, such as silt fencing and silt curtains, as deemed appropriate in site-specific design plans and in accordance with permit requirements;
- Immediately after the completion of project sections, plant native vegetation along stream banks;
- Concentrate work during dry periods to limit the potential for rutting and erosion into the stream; and
- Lower lake/pond water levels slowly.

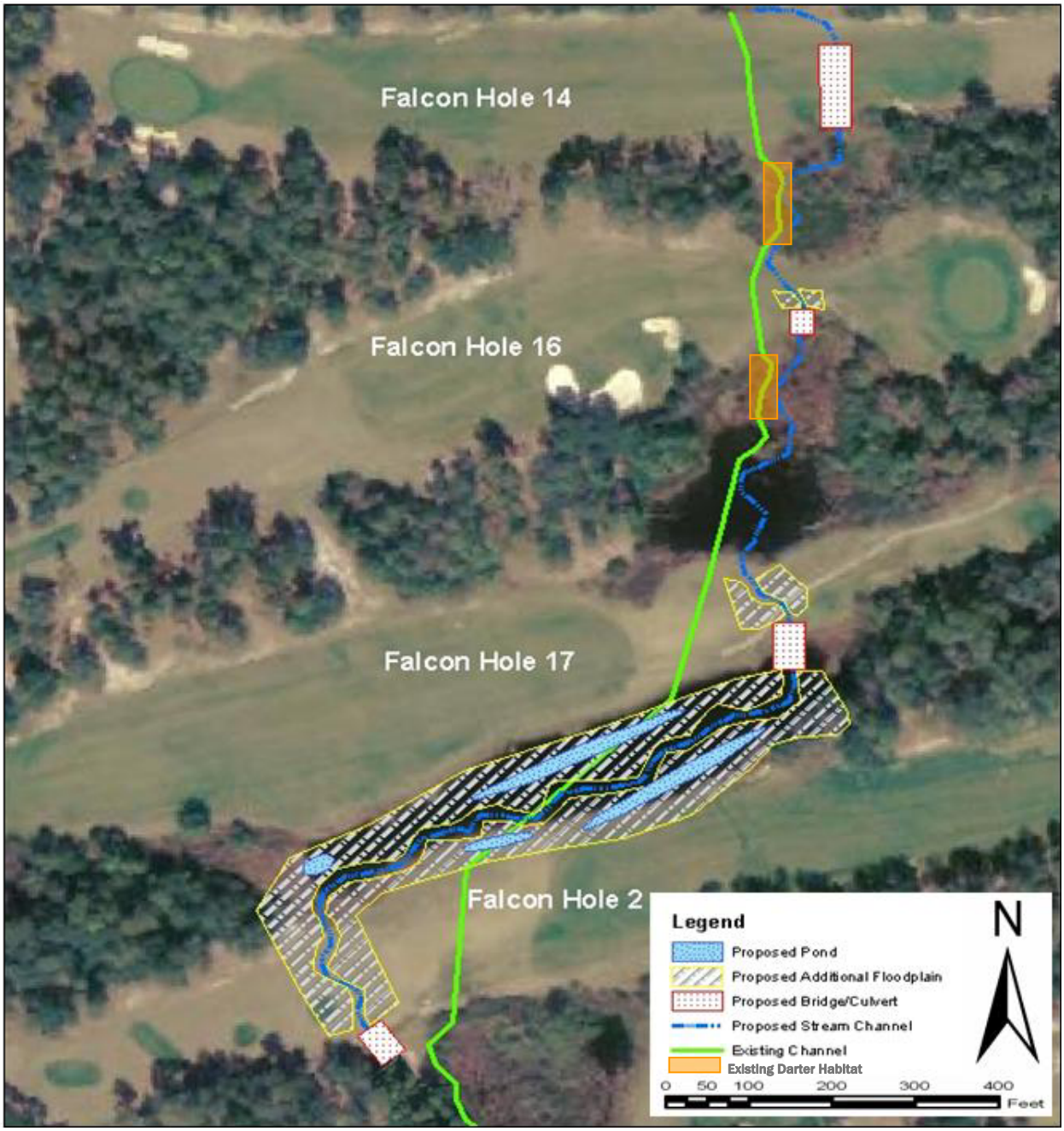

Figure 1. Proposed Mill Creek Restoration Area.

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/Critical Habitat Description

The Okaloosa darter, *Etheostoma okaloosae,* is a small percid fish (maximum size 49 millimeters Standard Length) with a well-developed humeral spot, a series of five to eight rows of small spots along the sides of the body, and a first anal spine longer than the second. General body coloration varies from red-brown to green-yellow dorsally, and lighter ventrally, although breeding males have a bright orange submarginal stripe on the first dorsal fin (Burkhead *et al*. 1992). The brown darter, *Etheostoma edwini*, is similar in size, but the blotched patterns on the sides are not organized into rows and breeding males have bright red spots on the body and fins. The Service listed the Okaloosa darter as endangered on June 4, 1973 (38 FR 14678). No critical habitat has been designated for this species.

Life History

The areas inhabited by the Okaloosa darter are typically the margins of flowing streams where detritus, root mats, and vegetation are present. Densities average about one darter in every 0.45 meters of stream length (Jordan and Jelks 2005). Okaloosa darters have not been collected in areas where there is no current nor have they been collected in the open, sandy areas in the middle of stream channels. Brown darters also occupy similar stream margins; however, they are capable of living in areas of little to no flow (Burkhead *et al.* 1994). Okaloosa darters feed primarily on fly (Diptera), mayfly (Ephemeroptera), and caddis fly (Trichoptera) larvae (Ogilvie 1980). The breeding season extends from late March through October, although it usually peaks in April. Spawning pairs have been videographed attaching one or two eggs to vegetation, and they also have been observed attaching eggs to woody debris and root mats (Burkhead *et al.* 1994; Collette and Yerger 1962). Ogilvie (1980) found a mean of 76 ova and 29 mature ova in 201 female Okaloosa darters. These numbers may under-represent annual fecundity as the prolonged spawning season is an indication of fractional spawning (i.e., eggs develop and mature throughout the spawning season). Estimates of longevity range from two to three years (Burkhead *et al.* 1992; Mettee and Crittenden 1979; Ogilvie 1980).

Status/Distribution

Okaloosa darters have been found only in the tributaries and main channels of Toms, Turkey, Mill, Swift, East Turkey, and Rocky Creeks, which drain into two bayous of Choctawhatchee Bay. Approximately 90 percent of the 457-square kilometer (176 square miles) drainage area of these six watersheds is within the boundaries of Eglin AFB (Fischer *et al.* 1994). The remainder is in the urban complex of Niceville and Valparaiso.

The Okaloosa darter was initially listed because of its extremely limited range and potential problems resulting from erosion, water impoundment, and competition with introduced brown darters. Since the listing in 1973, population levels in some stream sections have either decreased or disappeared altogether. In Swift Creek downstream of College Pond, no Okaloosa darters have been observed since 1987. Mill Creek has lost much of its Okaloosa darter habitat to erosion, culverts that restrict flow and cause bed aggradation, and beaver ponds associated with culverts. Populations appear stable or increasing in the upper reaches of the Boggy and Rocky Bayou stream systems since annual monitoring began in 1995.

Eglin AFB has maintained its system of unpaved roads by mining clay and sand from 144 pits of various sizes (Eglin 1993). Thirty-nine of these pits were located within or immediately adjacent to Okaloosa darter drainages and were sources of extreme erosion that covered stream vegetation with sediment (USFWS 1998). The roads themselves have also been sources of sediment altering darter habitat. Sediment runoff from unpaved roads and erosion associated with road crossings is likely the single-greatest remaining and continuing impact on Okaloosa darter habitat on the base. Sediment accumulating in darter streams smothers the aquatic vegetation and woody debris that these fish use as habitat and reduces channel capacity. Loss of channel capacity leads to greater bank erosion, channel widening, increased temperatures, and other alterations adverse to native aquatic species, including the darter.

Sand-filtered groundwater, the primary source for Okaloosa darter streams, is susceptible to depletion as the amount withdrawn from the sand-gravel aquifer increases (Barr *et al.* 1985). Increases in impermeable surfaces in the urban areas cause increased surface runoff with associated fluxes in water temperature and chemistry. Finally, the potential for catastrophic spills of toxic substances increases as traffic across Okaloosa darter streams expands in volume and extent.

The Service last revised its Recovery Plan for the Okaloosa darter in 1998. The plan calls for the Service to consider re-classification from endangered to threatened status using five criteria: 1) habitat protection status, 2) habitat restoration progress, 3) population size and structure, 4) population range, and 5) foreseeable threats. Natural resources management on Eglin has made substantial progress on tasks related to these criteria, especially in the area of habitat restoration. Eglin also has actively supported the surveys necessary to monitor trends in darter population size, structure, and range. Most of the 27 monitoring sites listed in the 1998 Recovery Plan are relatively stable or increasing (Jordan and Jelks 2005). The monitored sites that show declines in recent years are generally either outside Eglin's boundaries or near the base's border with the cities of Niceville and Valparaiso. These declines are most likely attributable to habitat alterations resulting from roads, urban development, or beaver impoundments. Beaver colonization of the downstream-portions of several darter streams near Eglin's interface with urban areas is apparently increasing, probably due to long-term fire-exclusion and a resulting increase in hardwood abundance (H. Jelks, Okaloosa darter status report, memo dated November 8, 2001).

Analysis of the species likely to be affected

The proposed action is to initiate a stream restoration project to benefit and further the recovery of the Okaloosa darter on Mill Creek. Areas of suitable habitat for the Okaloosa darter exist in the project area, although much of the habitat has been degraded by underground culverting and ponds for flood control. Darters persist in small numbers in the remnants of free-flowing stream between the ponds and culverts that Eglin installed to make the golf courses (Figure 1). The Okaloosa Darter Recovery Plan (USFWS 1998) identifies the Mill Creek darter population to be the most imperiled, and considers the improvement of conditions in Mill Creek as a vital step to the downlisting and delisting of this species. While the action is expected to benefit the species, individuals may be adversely affected during construction activities.

ENVIRONMENTAL BASELINE

Status of the Species within the Action Area

Mill Creek is the smallest of the six watersheds that support the Okaloosa darter, with a drainage area of just 1,126 acres (1.76 mi^2). All but the downstream-most ¼ mile of Mill Creek is on the base. Due to its small size and its location between the cities of Valparaiso and Niceville, Mill Creek may be the darter watershed that has the highest percentage of its acreage altered by human activities. Development of the Falcon and Eagle Golf Courses, which covers about half of the watershed and straddles the creek, extensively altered the terrain to accommodate the greens. Floodplain areas were filled and the creek itself was dammed or routed through culverts creating several impoundments. Some of these culverts have rusted and collapsed over the years, further impeding the movement of water, sediment, and fish. SR 190 (College Boulevard) bisects the north/south-oriented watershed, and the creek passes under fill material for the road through a set of culverts that apparently do not provide for efficient sediment transport, because upstream of these culverts, the stream is noticeably wider and shallower than more free-flowing sections of the stream. Beavers built dams near these culverts, which until removed in 2001, exacerbated the poor sediment transport capacity of the channel. Beaver control on Eglin is an ongoing conservation measure. Since December 2001, Eglin has captured and removed more than 50 beavers from Okaloosa darter drainages.

Immediately downstream of SR 190 is one of the 27 Okaloosa darter monitoring sites listed in the Recovery Plan. This site has the longest history of darter sampling in Mill Creek, but other sites both upstream and downstream of SR 190 have been sampled intermittently since 1959. Table 1 shows the numbers of darters collected at sites sampled within the Mill Creek watershed. The data in Table 1 were collected with variable effort and gear. Most samples were taken using a 6 ft x 10 ft x 1/8-in-mesh seine for about an hour in 20 to 50 meters of the stream channel; however recent surveys have used direct observation by snorkeling, which is the standard methodology at most of the annual monitoring sites listed in the Recovery Plan. Jordan et al. (in press) have shown that snorkeling detects about three darters for every one collected by seining, so the numbers in Table 1 could be multiplied by 3 to get a more accurate count of darters at

these locations.

Darter numbers at any particular site within Mill Creek are quite variable over time. The SR 190 site was once considered one of the best sites for sampling darters (H. Jelks, USGS, personal communication). This site is easily accessed from the road and on one occasion in 1989, it yielded 57 darters in a single 25-minute seining effort. In the last 10 years, surveys have counted 2 to 47 darters. In the 1998 Recovery Plan, the long-term mean number of darters reported for this site (n=12) was 12.1, with a standard deviation of 13.9. In 2004, the mean (n=19) has dipped to 10.1, with a standard deviation of 12.5. Analyses have not been performed for 2005 data, however the number of darters counted at this site was the highest in the past 10 years (47 darters).

Population stability in all six darter watersheds is a criterion for downlisting the species from endangered to threatened. The plan defines population stability operationally as:

1) Okaloosa darter numbers remain above 1.75 standard deviations below the cumulative long-term average at each of the monitoring sites;
2) the long-term trend in the average counts at each monitoring site is increasing or neutral; and
3) the range that the species inhabits is not decreased by more than a 500-meter stream reach within any of the six stream systems (USFWS 1998, Eglin Air Force Base 2006).

With the high variability in darter numbers at the Mill Creek monitoring site, the first element in the operational definition (average minus 1.75 standard deviations) results in a negative number, which means that detecting any darters at this site satisfies this component of stability. The second element, the trend in the counts, is not satisfied. The counts have been less than the 1998 mean of 12.1 since 1994, and a linear best-fit trend line to all the data has a slightly negative slope. It is unclear whether the third element, the species' range within the watershed is satisfied. Only one site, the SR 190 site, is routinely monitored in Mill Creek. Another site, at the 9th hole golf cart bridge (rkm 3.0) was sampled in 1989 (2 darters), 1999 (12 darters) 2004 (0 darters), and 2005 (6 darters) and represents the known upstream limit of darter distribution in this watershed.

Unlike four of the other six watersheds comprising the range of the Okaloosa darter, Mill Creek has no record of brown darters (*Etheostoma edwini*), which were believed to represent a threat to the survival of the Okaloosa darter through competitive interactions (Mettee et al. 1976).

The various fish surveys of Mill Creek listed in Table 1 suggest that darters inhabit only the section of the watershed upstream from about rkm 1.2, where the creek enters Plew Lake (an impoundment of Mill Creek on the golf course). The Service has no historical records of darter occurrence from downstream of Plew Lake to the mouth of the creek at Boggy Bayou. Based on this data, it appears that the range of the Okaloosa darter in the Mill Creek watershed is almost entirely within the Falcon and Eagle Golf Courses.

The Falcon and Eagle Golf Courses on Eglin border most of the length of Mill Creek. The Eagle golf course was constructed after the Okaloosa darter was listed as endangered so care was taken during planning and construction to minimize impacts to Mill Creek. Thus, the extant population of Okaloosa darters in the Mill Creek system resides almost entirely within the Eagle golf course. Darters persist in small numbers in the remnants of free-flowing stream between the ponds and culverts that Eglin installed to make the Falcon golf course. Culverts, roadfill, and in-basin retention areas on the Falcon golf course cause backwater and lack of streamside vegetation, and filled floodplains no longer function naturally. A series of culverts that cross each fairway eliminates darter habitat and alters natural stream processes.

The proposed action will re-establish approximately 1000 meters of suitable darter habitat within the Falcon golf course between rkm 0.7 and 1.7 (Figure 1). The persisting stream habitat (two segments totaling 80 meters) between the fairways for Holes 14, 16, and 17 will be left intact. Eglin proposes alterations to Falcon Holes 2, 16, and 17, removing the buried culverts, replacing them with free-flowing streams and floodplain, and installing bridges to allow cart and foot traffic. Native vegetation would be planted in the resulting streambeds and floodplain areas. The culvert at Hole 14 would be replaced with a new, shorter culvert with different intake and outflow points. The action is expected to take six to eight weeks to accomplish and is scheduled to occur outside of darter spawning season. This extensive stream restoration will increase available habitat for Okaloosa darters in Mill Creek by nearly 1 rkm and potentially increase the estimated size of the subpopulation by 40-50%.

Table 1. History of Okaloosa darter sampling in Mill Creek (sampling gear and effort variable) (sources: Howard Jelks, USGS; Jeffrey Herod, USFWS; USFWS 1998).

Site Description	River km[1]	Date of sample	# Okaloosa darters
Mouth of Mill Creek	0	0-Jun-05	0
Highway 20	0.2	12-May-05	0
Highway 20	0.2	27-May-05	0
Highway 20	0.2	10-Jun-05	0
rkm 0.6	0.6	27-May-05	0
100 m downstream SR190	1.7	30-Jan-90	13
100 m downstream SR190	1.7	16-Jun-90	7
100 m downstream SR190	1.7	19-Sep-91	2
100 m downstream SR190	1.7	27-Jun-92	7
100 m downstream SR190	1.7	28-Jan-93	9
100 m downstream SR190	1.7	4-Mar-94	6
100 m downstream SR190	1.7	26-Apr-95	7
Immediately downstream SR190	1.8	25-Apr-73	3
Immediately downstream SR190	1.8	5-May-74	4
Immediately downstream SR190	1.8	9-May-74	8

Site Description	River km[1]	Date of sample	# Okaloosa darters
Immediately downstream SR190	1.8	9-Feb-76	7
Immediately downstream SR190	1.8	25-Sep-79	2
Immediately downstream SR190	1.8	9-Jan-88	24
Immediately downstream SR190	1.8	23-Feb-89	57
Immediately downstream SR190	1.8	2-Jun-89	16
Immediately downstream SR190	1.8	12-Jul-89	8
Immediately downstream SR190	1.8	21-May-90	15
Immediately downstream SR190	1.8	4-Mar-94	13
Immediately downstream SR190	1.8	13-Sep-94	8
Immediately downstream SR190	1.8	21-Apr-95	2
Immediately downstream SR190	1.8	3-Aug-96	2
Immediately downstream SR190	1.8	12-Aug-01	2
Immediately downstream SR190	1.8	15-Apr-01	3
Immediately downstream SR190	1.8	15-Aug-01	3
Immediately downstream SR190	1.8	14-Oct-02	6
Immediately downstream SR190	1.8	13-Jul-04	15
Immediately downstream SR190	1.8	20-Jun-05	8
Immediately downstream SR190	1.8	21-Jun-05	3
Immediately downstream SR190	1.8	13-Sep-05	47
13th Hole Bridge	2.1	21-Jun-89	9
13th Hole Bridge	2.1	31-Jan-90	6
13th Hole Bridge	2.1	16-Jun-90	2
13th Hole Bridge	2.1	19-Sep-91	8
13th Hole Bridge	2.1	27-Jun-92	2
13th Hole Bridge	2.1	28-Jan-93	5
13th Hole Bridge, 50-100 m downstream	2.1	30-Jun-04	15
13th Hole Bridge, 0-50 m downstream	2.1	30-Jun-04	7
13th Hole Bridge, 0-50 m upstream	2.1	1-Jul-04	3
13th Hole Bridge, 50-100 m upstream	2.1	1-Jul-04	4
Tributary near 5th hole	2.5	31-Jan-90	0
Tributary near 5th hole	2.5	16-Jun-90	1
Tributary near 5th hole	2.5	19-Sep-91	0
Tributary near 5th hole	2.5	27-Jun-92	0
9th Hole Bridge	3	1989	2
9th Hole Bridge	3	1999	12
9th Hole Bridge, 0-50 m downstream of bridge, upstream of blowout	3	13-Jul-04	0
9th Hole Bridge, 0-50 m upstream of bridge, upstream of blowout	3	14-Jul-04	0
9th Hole Bridge, 20-40 m upstream of bridge	3	13-Sep-05	6

[1] Kilometers upstream from mouth of creek at Boggy Bayou.

EFFECTS OF THE ACTION

Factors to be considered

Okaloosa darters may still be found throughout its historic range in areas of suitable habitat and where threats have been managed, controlled or ameliorated. Our recent estimates indicate that about 300,000 (±100,000) Okaloosa darters exist within the six watersheds. Mill Creek is the smallest of these watersheds. Survey data from Mill Creek obtained during 2005 indicate that more than 2,000 Okaloosa darters inhabit Mill Creek between rkm 1.8 and 3.0, averaging 1.7 darters per linear meter of stream (H. Jelks, USGS, personal communication). The proposed work will impact two isolated stream segments inhabited by an estimated 136 Okaloosa darters. Site preparation and construction activities will have direct and indirect impacts to these fish and their habitat. Direct impacts may consist of crushing or burying individual Okaloosa darters and loss of habitat. Indirect impacts may consist of artificially altering water or habitat quality and behavior of Okaloosa darters within the stream segments.

Proximity of Action: Darters persist in small numbers in the remnants of free-flowing stream between the ponds and culverts that Eglin installed to make the Falcon golf course (Figure 1). Two segments (50 and 30 meters in length) exist within the restoration area. Although Eglin has no plans to alter the existing stream segments inhabited by the Okaloosa darter, these stream segments will be impacted as a result of the restoration activities.

Distribution: The Okaloosa darter occurs in only six watersheds that drain into Boggy and Rocky Bayous along the north side of Choctawhatchee Bay. Mill Creek is the smallest of these, with a drainage area of less than two square miles out of the 176 square-mile total area of the six drainages. The Falcon and Eagle Golf Courses on Eglin border most of the length of Mill Creek. Culverts, roadfill, and in-basin retention areas on the golf courses cause backwater and lack of streamside vegetation, and filled floodplains no longer function naturally. A series of culverts that cross each fairway eliminates darter habitat and alters natural stream processes. Darters persist in small numbers in the remnants of free-flowing stream between the ponds and culverts that Eglin installed to make the golf courses (Figure 1).

Timing: Okaloosa darters reproduce from March through August with peak spawning occurring from April to June. Activities during breeding season could impair successful reproduction by Okaloosa darters inhabiting the action area. The development activities will occur during the months of September through February, outside of spawning season.

Nature of the Effect: The direct loss of individual Okaloosa darters may be detrimental to the genetic diversity of the remaining Mill Creek subpopulation. However, connection of isolated stream segments to the more contiguous habitat upstream will allow immigration by individuals into the restored stream habitat, offsetting detrimental genetic effects that may have resulted from isolation in the two stream segments within the Falcon golf course. The direct loss of habitat (9 meters) and the impacts to water quality in the two stream segments (80 meters) may contribute to population reduction in the Action Area. While the loss or impairment of habitat

will adversely affect the species we must also consider the importance of the habitat to the conservation of the species. The stream restoration proposed by Eglin will likely improve degraded habitat conditions in Mill Creek and negative impacts to the existing stream segments are likely temporary and reversible. This extensive stream restoration will increase available habitat for Okaloosa darters in Mill Creek by nearly 1 rkm and potentially increase the estimated size of the subpopulation by 40-50%.

Duration: There will be initial temporary short-term, negative impacts to Okaloosa darters during site preparation and construction in the form of habitat loss (9 meters) and degradation (80 meters). Permanent impacts of the action will be largely beneficial, re-establishing stream habitat (1 rkm) and reconnecting isolated habitat to more contiguous habitat upstream.

Disturbance frequency: Following the initial impacts to Okaloosa darters during site preparation and construction, the remaining habitat onsite would be permanently protected. Therefore, the proposed action would only result in a one-time disturbance to the Okaloosa darters within the Action Area.

Disturbance intensity and severity: The proposed action would permanently recreate approximately 1 rkm of suitable Okaloosa darter habitat. Temporary impacts are expected to be limited to the construction phase of the project, which would be expected to be completed in eight to twelve weeks. As the life span of an Okaloosa darter is estimated to be 3-4 years, the temporary impacts of the proposed action will not affect multiple generations. Recolonization of the restored and protected habitat remaining onsite would be expected within months to years. The severity would be reduced by implementing many of the conservation measures in the proposal, including but not limited to, employing the least intrusive methods available for completing the proposed action near Mill Creek; complete the majority of new channel construction at each section prior to the routing of water from the old stream channel into the new channel; using erosion control measures, such as silt fencing and silt curtains, as deemed appropriate in site-specific design plans and in accordance with permit requirements; immediately after the completion of project sections, planting native vegetation along stream banks; concentrating work during dry periods to limit the potential for rutting and erosion into the stream; and completion of the project outside the spawning season.

Analysis for Effects for the Action

The activities described in the BA for the Mill Creek restoration have the potential to impact the Okaloosa darter. Potential negative impacts to the Okaloosa darter would be short-term, affecting approximately 80 meters of suitable darter habitat, which represents less than one percent of the species range (about 400 stream km). Survey data from Mill Creek obtained during 2005 indicate that more than 2,000 Okaloosa darters inhabit Mill Creek between rkm 1.8 and 3.0, averaging 1.7 darters per linear meter of stream (H. Jelks, USGS, personal communication). Application of the Mill Creek average to the stream segments likely inhabited within the restoration area yields an estimate of 136 darters potentially impacted by the proposed action, representing 6.5% of the Mill Creek population and 0.04% of the entire Okaloosa darter population.

Direct effects: Stream restoration activities in and near Mill Creek are likely to cause direct impacts to the darter where newly created stream segments are connected to the existing stream habitat in the restoration site (Figure 1). Destruction or modification of up to 3 meters of existing stream is likely to occur at each of the three connection points, potentially resulting in displacement or mortality of up to 15 Okaloosa darters.

Indirect effects: Short-term water quality and habitat degradation and temporary blockage of fish passage may cause indirect impacts in feeding patterns, respiratory functioning, and habitat use throughout the existing stream habitat. Sedimentation from soil disturbance in and near the stream may interfere with proper respiratory functioning, smother aquatic vegetation and woody debris that darters use as habitat, and reduce channel capacity. Loss of channel capacity leads to greater bank erosion, channel widening, increased temperatures and other alterations adverse to the darter. The incorporation of the avoidance and minimization measures outlined above should greatly reduce the potential impacts to Okaloosa darters present in the restoration area but some degree of negative impact in the form of sedimentation and habitat instability is still likely to occur. However, long-term beneficial impacts are likely once the project is completed.

Beneficial effects: The long-term beneficial effects for Mill Creek are the reason for this project. The new stream channel and floodplain will provide substantially improved Okaloosa darter habitat than the presently degraded condition of Mill Creek. The restored stream will provide more than 600 meters of improved habitat for the darter due to the return of more natural stream features and functions, such as stream-floodplain connectivity and a meandering channel that allows for increased habitat diversity.

Species Response to a Proposed Action

Because the existing stream segments inhabited by Okaloosa darters are currently considered degraded from isolation during construction of the Falcon golf course and activities associated with golf course maintenance (i.e., fertilization), the proposed action will likely benefit the

darters inhabiting these segments by increasing the available habitat and reconnecting these isolated subpopulations to the Mill Creek population. The temporary loss of habitat due to construction activities may result in the loss of individuals. However, the proposed action would result in only a one-time disturbance to the Okaloosa darters within the Action Area. Temporary impacts are expected to be limited to the construction phase of the project, which would be expected to be completed within three months. Colonization or recolonization of the newly recreated, restored, and protected habitat remaining onsite would be expected within several months, with spawning occurring in the following spring/summer as suitable habitat is established. Eglin will institute conservation measures that minimize the project footprints such that effects to existing stream habitat within the restoration site will be limited. Restored habitat will be maintained and protected in perpetuity.

The applicants have also committed to provide funding for management activities and other restoration projects for Okaloosa darters within and outside the action area. These funds will be used to implement conservation and recovery needs for Okaloosa darters that would have a greater benefit to the species range wide. Activities that may be funded with these contributions have been identified in the Recovery Plan and include, but are not limited to: conducting surveys to determine the current status and distribution of Okaloosa darter; stream habitat restoration and/or enhancement; and research to develop the information necessary to achieve conservation.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. All but the lower-most ¼ mile of Mill Creek (from which Okaloosa darters have never been recorded) is within the boundaries of Eglin Air Force Base. Therefore, no non-federal actions are reasonably certain to occur in the action area.

CONCLUSION

After reviewing the current status of the Okaloosa darter, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is the Service's biological opinion that the proposed stream restoration project is not likely to jeopardize the continued existence of the Okaloosa darter. No critical habitat has been designated for this species; therefore, none will be affected.

The stream restoration proposed by Eglin will likely improve degraded habitat conditions in Mill Creek and negative impacts are likely temporary and reversible. Populations in Turkey and Rocky Creek, the two largest of the six darter watersheds, are generally stable or increasing, and are unaffected by these actions in the smallest watershed. Populations in the remaining three

watersheds are less stable and conservation/recovery actions have been designed to eliminate threats to the species and identify causes for population instability. Our analysis is based on current activities within the range of the Okaloosa darter. Urbanization or changes in landuse practices resulting from altered military missions could result in additional population stress and potentially threaten the Okaloosa darter and its habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering [50 CFS §17.3]. Incidental take is defined as take that is incidental to, and not the purpose of, an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by Eglin so that they become binding conditions of any grant or permit issued by Eglin, as appropriate, for the exemption in section 7(o)(2) to apply. Eglin has a continuing duty to regulate the activity covered by this incidental take statement. If Eglin: (1) fails to assume and implement the terms and conditions or, (2) fails to require any contracted group to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Eglin must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(I)(3)]

AMOUNT OR EXTENT OF TAKE ANTICIPATED

As described above (Effects of the Action), we estimate that up to 136 Okaloosa darters will be impacted by the Mill Creek restoration project. The incidental take is expected to be in the form of indirect impacts resulting from impaired water quality and habitat degradation. However, injury or mortality of up to 15 individuals is possible. Our estimate is based on: 1) 80 meters of existing stream habitat in the restoration area; 2) a population density of 1.7 fish per meter (Jordan and Jelks 2005); and 3) knowledge of stream restoration techniques which suggest that each connection of newly created stream to the existing stream will destroy or modify up to 3 meters of existing Okaloosa darter habitat. Injury or mortality would occur either from the direct

impact of the necessary operation of heavy equipment within the stream or smothering by sediment dislodged from banks during construction operations. Because this is a stream restoration project, Eglin proposes to stabilize stream banks and utilize erosion control measures along the stream, we do not anticipate take resulting from longer-term erosion and degradation of darter habitat.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take will not result in jeopardy to the species or destruction or adverse modification of critical habitat. Measures to reduce potential impacts to the Okaloosa darter have been incorporated into the plans for this habitat restoration project.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize the incidental take of the Okaloosa darter:

Eglin shall ensure full implementation of the conservation measures, as outlined in the BA, that address Okaloosa darter during the proposed Mill Creek stream restoration project on Falcon Golf course.

TERMS AND CONDITIONS

In order to be exempt from the prohibition of section 9 of the Act, Eglin must comply with the following terms and conditions, which implement the reasonable and prudent measures. All conservation measures described in the BA are hereby incorporated by reference as terms and conditions within this document pursuant to 50 CFR § 402.14(I) with the addition of the following terms and conditions. The terms and conditions listed are non-discretionary.

1. Employ the least intrusive methods available for completing the proposed action near Mill Creek;
2. Complete the majority of new channel construction at each section prior to the routing of water from the old stream channel into the new channel;
3. Use erosion control measures, such as silt fencing and silt curtains, as deemed appropriate in site-specific design plans and in accordance with permit requirements;
4. Immediately after the completion of project sections, plant native vegetation along stream banks;
5. Concentrate work during dry periods to limit the potential for rutting and erosion into the stream;
6. Lower lake/pond water levels slowly;
7. Construction workers and contractors shall be educated on the presence of the endangered Okaloosa darter and measures they can take to minimize impacts.

Monitoring

Monitoring for this action shall be conducted for 4 years post construction. The final monitoring design shall be determined and carried out by the Service in coordination with Eglin natural resources managers and other partners. Monitoring designs for stream geomorphology, water quality, hydrology, and Okaloosa darter population size will be based on the best available scientific data and shall be provided to Eglin prior to initiation of the monitoring program. In order to establish baseline conditions, the monitoring program is to begin prior to initiation of the proposed action.

Reporting

Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the Fish and Wildlife Service Law Enforcement Office, Clermont, Florida at (352) 429-1037 within 24 hours. Additional notification must be made to the Fish and Wildlife Services Field Office at Panama City, Florida at (850) 769-0552 within 48 hours. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed actions at the development. The Service believes that up to 136 Okaloosa darters may be incidentally taken indirectly by degraded water quality and habitat alteration. No more than 15 fish will be incidentally taken by direct injury or mortality as a result of the project construction.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the Act by conducting conservation programs for the benefit of endangered and threatened species. Towards this end, conservation recommendations are discretionary activities that an action agency may undertake to minimize or avoid the adverse effects of a proposed action, help implement recovery plans, or develop information useful for the conservation of listed species.

Comprehensive restoration of Mill Creek would address the entire length of the stream on the base. The goal of restoration should be to create or preserve those channel and riparian zone conditions that will carry the watershed's flow and sediment regime without substantial erosion or aggradation, while providing a quality habitat for the darter and other native species and a quality landscape feature for the golf course. Restoration should remedy to the extent practicable the existing problems, noted in this opinion, of poorly functioning culverts, impoundments, creosote-treated timbers in the stream, etc. Management activities on the golf

course that may affect the stream and riparian zone, e.g., fertilizer and pesticide applications, tree trimming, etc., should be consistent with the goal of restoration. The Service is available to assist with restoration planning, implementation, and monitoring.

Eglin is listed as the lead agency for completing several tasks described in the Okaloosa darter Recovery Plan that are applicable to Mill Creek, all of which could be incorporated into a comprehensive restoration of the creek:

Task Number	Task Description
1.2.1	Stabilize headwater banks on the golf course.
1.2.2	Remove impediments to flow such as sediment beds, beaver dams, and clogged culverts.
1.2.3	Minimize the use of pesticides, herbicides, and other contaminants on the golf course that impact Mill Creek darters by developing and implementing a chemical use plan.
1.3.1	Evaluate Eglin AFB ponds for ecological restoration.
3.2.1	Investigate the load of nutrients and contaminants from the Eglin golf course by studying chemical use needs and using indicator aquatic insect surveys.
4.2	Summarize best management practices for golf course operation that are important to the survival and recovery of the Okaloosa darter in Mill Creek.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the BA. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information shows that the action may affect listed species in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

We appreciate the cooperation of your staff in preparing this Biological Opinion. We look forward to working closely with you in implementing its provisions and actions for the Okaloosa darter. If you have any questions about this opinion or consultation, please contact Mr. Jerry Ziewitz at ext. 223.

Sincerely yours,

Gail A. Carmody
Field Supervisor

cc:
USFWS, Niceville, FL (Bill Tate)
USGS, Gainesville, FL (Howard Jelks)
FWC, Tallahassee, FL (Ted Hoehn)
FWS, Atlanta, GA (Joe Johnston) – electronic copy

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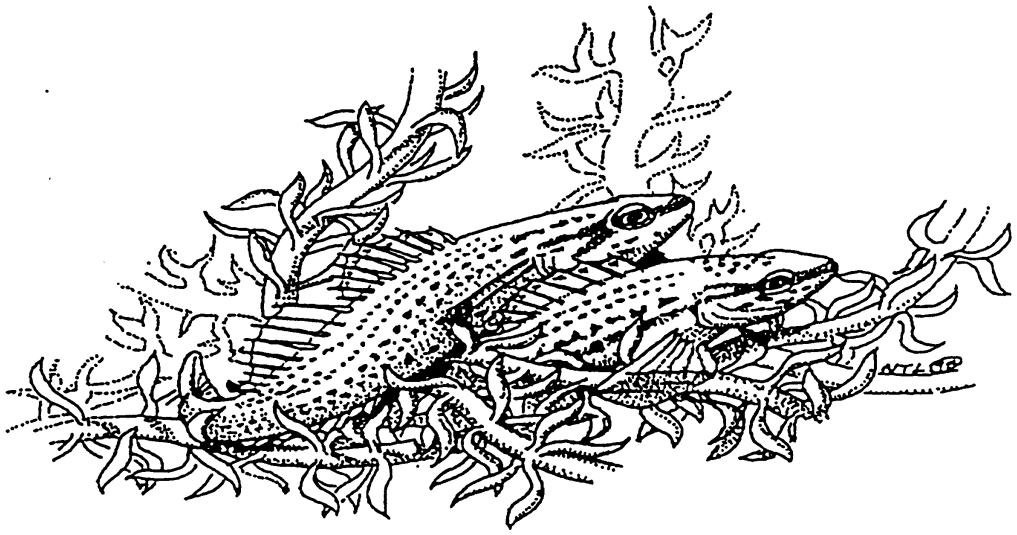
ATTACHMENT C

Okaloosa Darter Recovery Plan

U.S. Fish & Wildlife Service

Recovery Plan for Okaloosa Darter

Etheostoma okaloosae



U.S. Fish and Wildlife Service
Southeast Region
Atlanta, Georgia

OKALOOSA DARTER (*Etheostoma okaloosae*)

RECOVERY PLAN
(Revised)

Original Approved: April 18, 1981

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Southeast Region
Atlanta, Georgia

Approved: Sam D. Hamilton
Regional Director, U.S. Fish and Wildlife Service

Date: 10-26-98

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect species. Plans published by the U.S. Fish and Wildlife Service are sometimes prepared with the assistance of recovery teams, contractors, State agencies, and other affected and interested parties. Plans are reviewed by the public and submitted to additional peer review before they are adopted by the Service. Objectives of the plan will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not obligate other parties to undertake specific tasks and may not represent the views nor the official positions or approval of any individuals or agencies involved in developing the plan, other than the U.S. Fish and Wildlife Service. Recovery plans represent the official position of the U.S. Fish and Wildlife Service **only** after they have been signed by the Director or a Regional Director as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

By approving this document, the Regional Director certifies that the data used in its development represent the best scientific and commercial data available at the time it was written. Copies of all documents reviewed in development of the plan are available in the administrative record, located at the Panama City, Florida Field Office.

LITERATURE CITATION of this document should read as follows:

U.S. Fish and Wildlife Service. 1998. Okaloosa Darter (*Etheostoma okaloosae*) Recovery Plan (Revised). Atlanta, Georgia. 42 pp.

Additional copies of this plan may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814

Telephone: 301/492-6403 or
800/582-3421

Fees for recovery plans vary, depending upon the number of pages.

Cover illustration by: Mr. Noah Lowenthal, University of Florida student (1995). Mr. Lowenthal used the University collections for this drawing.

ACKNOWLEDGEMENTS

The authors appreciate critical comments made on drafts of the manuscript from colleagues in several local, State, and Federal agencies. We would also like to recognize the contributions of Lloyd G. Stith and Gail A. Carmody of the U.S. Fish and Wildlife Service for their thoughtful reviews of an earlier version of this plan.

EXECUTIVE SUMMARY

Current Status: The endangered Okaloosa darter occurs in only six stream systems, which are located in Okaloosa and Walton Counties, Florida. Its restricted range has been further reduced by habitat modification and subsequent increases in the brown darter population.

Habitat Requirements and Limiting Factors: Okaloosa darters typically inhabit the margins of small streams fed by groundwater seeping from surrounding sandhills. Vegetation, woody debris, and root mats are used as spawning substrate. Okaloosa darters tend to avoid open sand stretches without cover and areas where stream flow is negligible. The potentially competitive brown darter occupies similar habitats in the lower reaches of streams in the Rocky Bayou system, although it tolerates areas with minimal current. Okaloosa darters have decreased in numbers and range where streams are impounded or subjected to extreme sediment loading. Natural processes (i.e., fire, flood, sediment transport, and vegetative succession) maintain headwater stream sections with characteristics that foster healthy Okaloosa darter populations.

Recovery Objective: Downlisting, and eventually delisting, the Okaloosa darter by enabling wild populations capable of coping with natural habitat fluctuations to persist indefinitely in the six stream systems they inhabit by restoring and protecting stream habitat, water quality, and water quantity.

Recovery Criteria: Downlisting to threatened may be considered when (1) the habitat and historical flows in all six systems are protected by cooperative agreements that appear likely to remain permanent, and (2) monitoring shows that Okaloosa darter populations in all six inhabited stream systems remain stable or increasing for 5 consecutive years. Delisting may be considered when (1) historic habitat of all six streams have been restored, (2) cooperative and enforceable agreements to protect habitat, water quality and stream flows are in effect, and (3) monitoring shows the populations in all six stream systems remain stable or increasing for a 20-year hydrologic cycle.

Actions Needed:

1. Restore and protect habitat in the six Okaloosa darter stream watersheds.
2. Protect water quality and quantity in the six Okaloosa darter streams.
3. Monitor and annually assess populations and habitat conditions of Okaloosa and brown darters, and water quality and quantity in the streams.
4. Establish a public information and education program and evaluate its effectiveness.

Costs ($000s):

Year	Need 1	Need 2	Need 3	Need 4	Total
1999	990	68	136	2	1,196
2000	770	53	121	2	946
2001	549	31	121	2	703
2002	319	1	121	2	443
2003	319	1	121	2	443
Total Cost of Recovery	2,947	154	620	10	3,731

Costs are estimated for the next five years of recovery efforts.

Date of Recovery: Downlisting should be initiated in 2001, if recovery criteria are met. Delisting should be initiated in 2016, if recovery criteria are met.

TABLE OF CONTENTS

PART I

INTRODUCTION

The Okaloosa darter, *Etheostoma okaloosae*, is known to occur in only six clear stream systems that drain into two Choctawhatchee Bay bayous in northwest Florida (Figure 1). The U.S. Fish and Wildlife Service (Service) included the species on the List of Endangered and Threatened Wildlife and Plants on June 4, 1973 (38 FR 14678). The extremely limited range of the darter and the amount of its habitat degraded by road and dam construction, as well as siltation from land clearing, were primary factors in the initial listing. In 1964, a potential competitor, the brown darter, *Etheostoma edwini*, was found in sections of four of the six Okaloosa darter streams. Mettee (1970) documented that the brown darter was increasing in both spatial range and numbers in some of the streams in the Rocky Bayou drainage. Siltation and impoundment continue to impact the species, but the two darter species seem to have reached a tenuous balance. Okaloosa darters dominate Boggy Bayou streams and headwater sections of Rocky Bayou streams, while brown darters occupy the lower reaches of Rocky Bayou streams. Additional threats include continued urbanization, ground and surface water withdrawal, and vulnerability to catastrophic, hazardous material spills.

A. Description and Taxonomy

The Okaloosa darter is a small percid fish (maximum size 49 millimeters Standard Length) that is characterized by a well-developed humeral spot, a series of five to eight rows of small spots along the sides of the body, and the first anal spine being longer than the second. General body coloration varies from red-brown to green-yellow dorsally, and lighter ventrally, although breeding males have a bright orange submarginal stripe on the first dorsal fin (Burkhead *et al.* 1992). The brown darter is similar in size, but the blotched patterns on the sides are not organized into rows and the breeding males have bright red spots on the body and fins.

The Okaloosa darter was first described as *Villora okaloosae* by Fowler (1941) from a single specimen collected by Francis Harper in 1939 at the headwaters of Little Rocky Creek (Figure 2, river kilometer (RKM) 10.9). The species was not collected again until 1959. Bailey *et al.* (1954) later synonymized the Okaloosa darter with the Gulf darter, *Etheostoma swaini*, in their Escambia River study. Collette and Yerger (1962) reestablished the Okaloosa darter as a legitimate species, which belonged in the subgenus *Villora* along with *E. edwini*, and did the first comprehensive review of collections. They concluded that the Okaloosa darter was a primitive relict species that had been reproductively isolated from the derived brown darter by Pleistocene interglacial sea levels (Neill 1957; Collette and Yerger 1962). Page (1981) reviewed the taxonomic relationships of 142 darter species based on 52 morphological characters. He placed *E. okaloosae*, along with *E. mariae* and *E. fricksium*, in the subgenus *Belophlox*. The latter

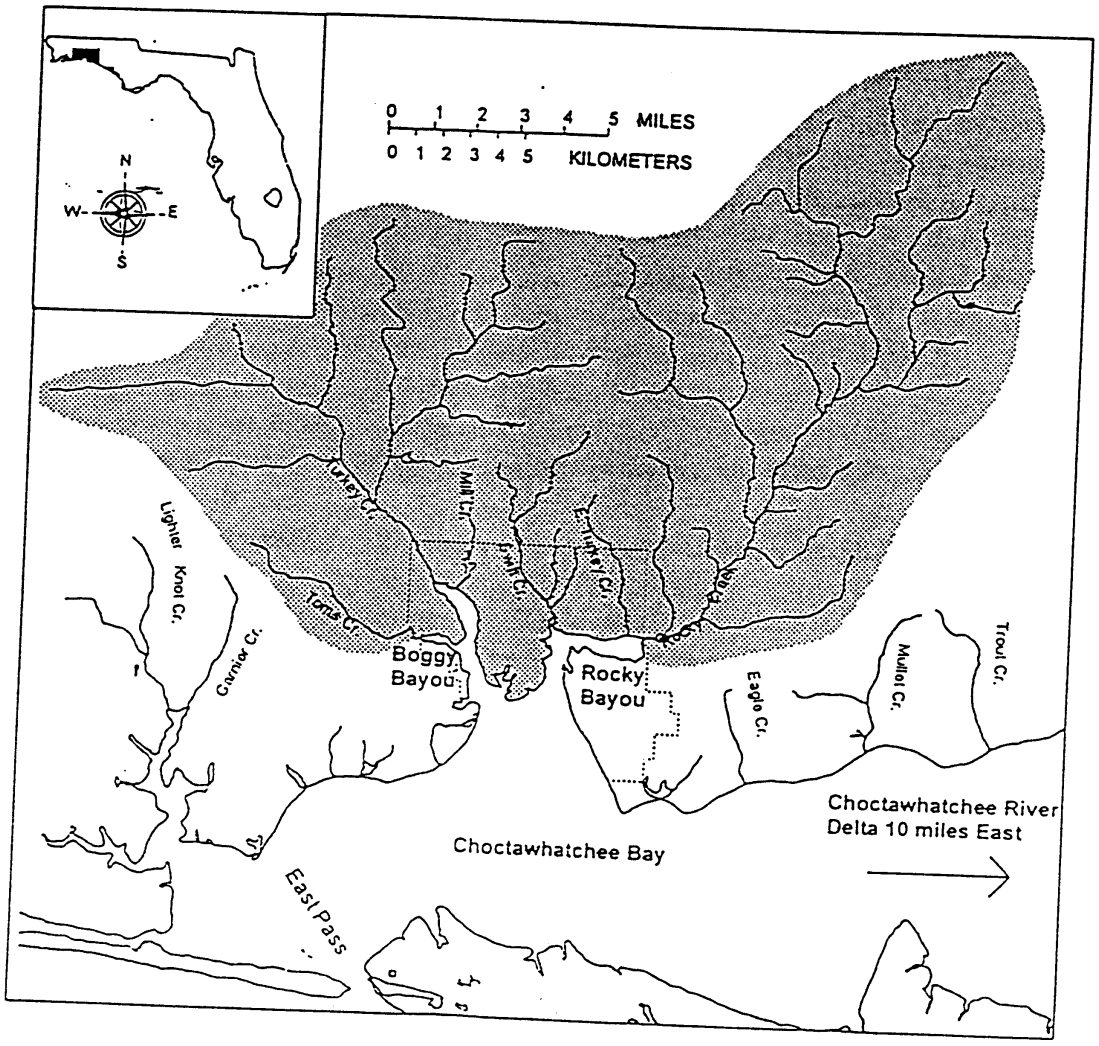
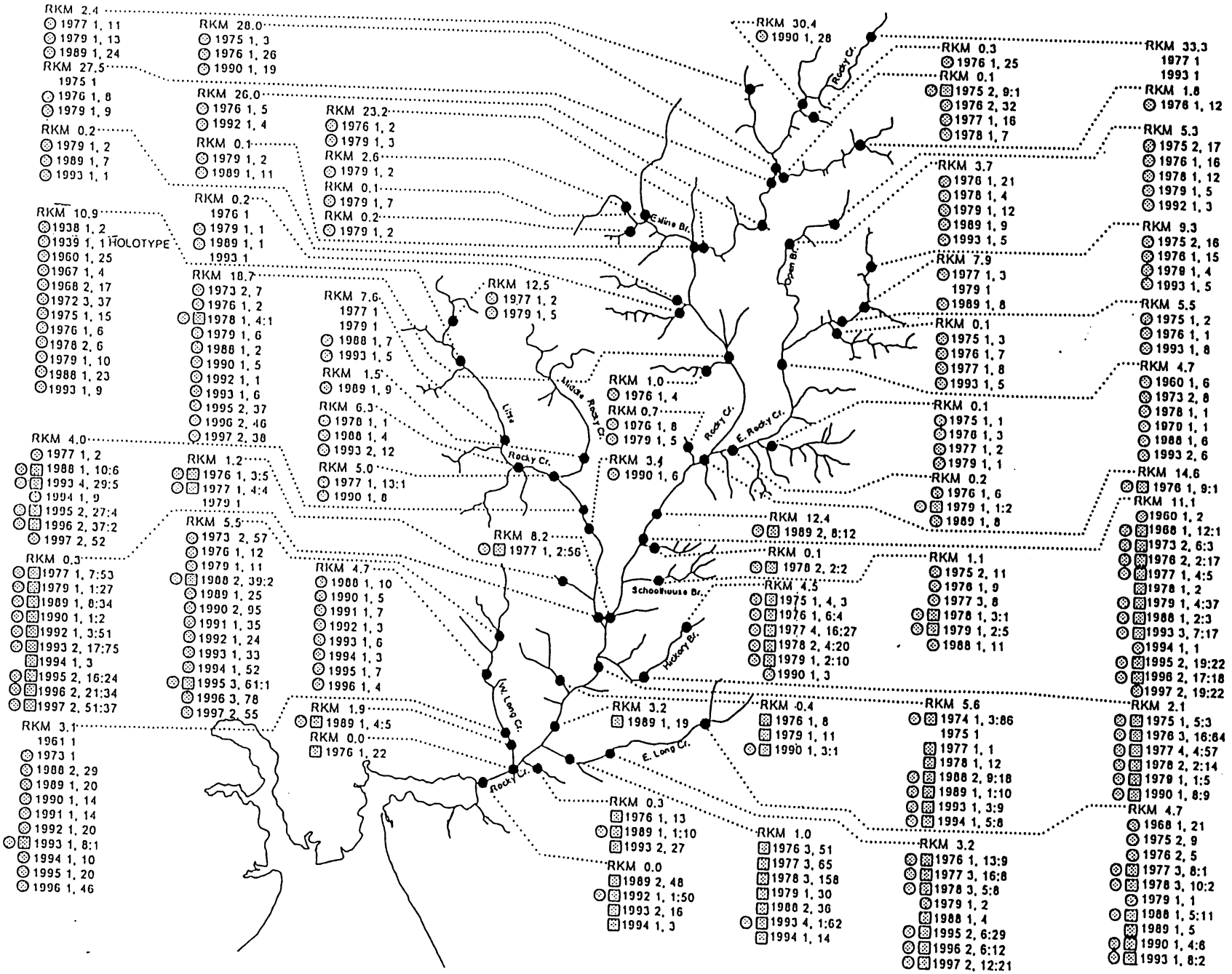


Figure 1. The six stream systems of Rocky and Boggy Bayous that comprise the range of the endangered Okaloosa darter (shaded area). Unshaded streams represent areas where brown darters have been collected and possible sources of dispersing brown darters. Brown darters are also found in the lower reaches of Swift, East Turkey, and Rocky Creeks. Dotted line indicates the boundary between Eglin Air Force Base and the cities of Niceville and Valparaiso.

Figure 2. The geochronology of the Okaloosa and brown darters from collections of the Rocky Creek system, Choctawhatchee Bay drainage, Florida. Solid circles reflect sampling site, while the digits following "RKM" refer to number of river kilometers to a confluence. The presence of Okaloosa darters (shaded circles) and brown darters (shaded squares) are followed by the year of collections, number of collections, and number of individuals collected, respectively (Okaloosa darters:brown darters).


RKM 2.4
1977 1, 11
1979 1, 13
1989 1, 24
RKM 27.5
1975 1
1976 1, 8
1979 1, 9
RKM 0.2
1979 1, 2
1989 1, 7
1993 1, 1
RKM 10.9
1938 1, 2
1939 1, 1 HOLOTYPE
1960 1, 25
1967 1, 4
1968 2, 17
1972 3, 37
1975 1, 15
1976 1, 6
1978 2, 6
1979 1, 10
1988 1, 23
1993 1, 9
RKM 4.0
1977 1, 2
1988 1, 10:6
1993 4, 29:5
1994 1, 9
1995 2, 27:4
1996 2, 37:2
1997 2, 52
RKM 0.3
1977 1, 7:53
1979 1, 1:27
1989 1, 8:34
1990 1, 1:2
1992 1, 3:51
1993 2, 17:75
1994 1, 3
1995 2, 16:24
1996 2, 21:34
1997 2, 51:37
RKM 3.1
1961 1
1973 1
1988 2, 29
1989 1, 20
1990 1, 14
1991 1, 14
1992 1, 20
1993 1, 8:1
1994 1, 10
1995 1, 20
1996 1, 46
RKM 28.0
1975 1, 3
1976 1, 26
1990 1, 19
RKM 26.0
1976 1, 5
1992 1, 4
RKM 0.1
1979 1, 2
1989 1, 11
RKM 0.2
1976 1
1979 1, 1
1989 1, 1
1993 1
RKM 18.7
1973 2, 7
1976 1, 2
1978 1, 4:1
1979 1, 6
1988 1, 2
1990 1, 5
1992 1, 1
1993 1, 6
1995 2, 37
1996 2, 46
1997 2, 38
RKM 1.2
1976 1, 3:5
1977 1, 4:4
1979 1
RKM 5.5
1973 2, 57
1976 1, 12
1979 1, 11
1988 2, 39:2
1989 1, 25
1990 2, 95
1991 1, 35
1992 1, 24
1993 1, 33
1994 1, 52
1995 3, 61:1
1996 3, 78
1997 2, 55
RKM 23.2
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1979 1, 3
RKM 2.6
1979 1, 2
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1979 1, 7
RKM 0.2
1979 1, 2
RKM 7.6
1977 1
1979 1
1988 1, 7
1993 1, 5
RKM 1.5
1989 1, 9
RKM 6.3
1978 1, 1
1988 1, 4
1993 2, 12
RKM 5.0
1977 1, 13:1
1990 1, 8
RKM 4.7
1988 1, 10
1990 1, 5
1991 1, 7
1992 1, 3
1993 1, 6
1994 1, 3
1995 1, 7
1996 1, 4
RKM 1.9
1989 1, 4:5
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RKM 12.5
1977 1, 2
1979 1, 5
RKM 1.0
1976 1, 4
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1976 1, 8
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1990 1, 6
RKM 8.2
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1976 1, 13
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1993 2, 27
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1989 2, 48
1992 1, 1:50
1993 2, 16
1994 1, 3
RKM 30.4
1990 1, 28
RKM 0.3
1976 1, 25
RKM 0.1
1975 2, 9:1
1976 2, 32
1977 1, 16
1978 1, 7
RKM 3.7
1976 1, 21
1978 1, 4
1979 1, 12
1989 1, 9
1993 1, 5
RKM 7.9
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1975 1, 3
1976 1, 7
1977 1, 8
1993 1, 5
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1976 1, 3
1977 1, 2
1979 1, 1
RKM 0.2
1976 1, 6
1979 1, 1:2
1989 1, 8
RKM 12.4
1989 2, 8:12
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1978 2, 2:2
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1975 1, 4, 3
1976 1, 6:4
1977 4, 16:27
1978 2, 4:20
1979 1, 2:10
1990 1, 3
RKM 0.4
1976 1, 8
1979 1, 11
1990 1, 3:1
RKM 1.0
1976 3, 51
1977 3, 65
1978 3, 158
1979 1, 30
1988 2, 36
1993 4, 1:62
1994 1, 14
RKM 33.3
1977 1
1993 1
RKM 1.8
1976 1, 12
RKM 5.3
1975 2, 17
1976 1, 16
1978 1, 12
1979 1, 5
1992 1, 3
RKM 9.3
1975 2, 16
1976 1, 15
1979 1, 4
1993 1, 5
RKM 5.5
1975 1, 2
1976 1, 1
1993 1, 8
RKM 4.7
1960 1, 6
1973 2, 8
1978 1, 1
1979 1, 1
1988 1, 6
1993 2, 6
RKM 14.6
1976 1, 9:1
RKM 11.1
1960 1, 2
1968 1, 12:1
1973 2, 6:3
1976 2, 2:17
1977 1, 4:5
1978 1, 2
1979 1, 4:37
1988 1, 2:3
1993 3, 7:17
1994 1, 1
1995 2, 19:22
1996 2, 17:18
1997 2, 19:22
RKM 1.1
1975 2, 11
1976 1, 9
1977 3, 8
1978 1, 3:1
1979 1, 2:5
1988 1, 11
RKM 5.6
1974 1, 3:86
1975 1
1977 1, 1
1978 1, 12
1988 2, 9:18
1989 1, 1:10
1993 1, 3:9
1994 1, 5:8
RKM 3.2
1976 1, 13:9
1977 3, 16:8
1978 3, 5:8
1979 1, 2
1988 1, 4
1995 2, 6:29
1996 2, 6:12
1997 2, 12:21
RKM 2.1
1975 1, 5:3
1976 3, 16:64
1977 4, 4:57
1978 2, 2:14
1979 1, 1:5
1990 1, 8:9
RKM 4.7
1968 1, 21
1975 2, 9
1976 2, 5
1977 3, 8:1
1978 3, 10:2
1979 1, 1
1988 1, 5:11
1989 1, 5
1990 1, 4:6
1993 1, 8:2
E. Mine Br.
Open Br.
Little Rocky Cr.
Rocky Cr.
E. Rocky Cr.
Schoolhouse Br.
Hickory Br.
W. Long Cr.
E. Long Cr.

two geographically-disjunct species occur on the lower Atlantic slope from Georgia and southeastern North Carolina, thus implying that the ancestor to the Okaloosa darter was widespread. *E. edwini* was left as the sole species in the subgenus *Villora*, while *E. swaini* was put with 14 other species in the subgenus *Oligocephalus*. Bailey and Etnier (1988) did the most recent revision of darters and placed *E. okaloosae* in the subgenus *Oligocephalus* and following Page (1981), retained *E. edwini* in the monotypic subgenus *Villora*.

B. Distribution

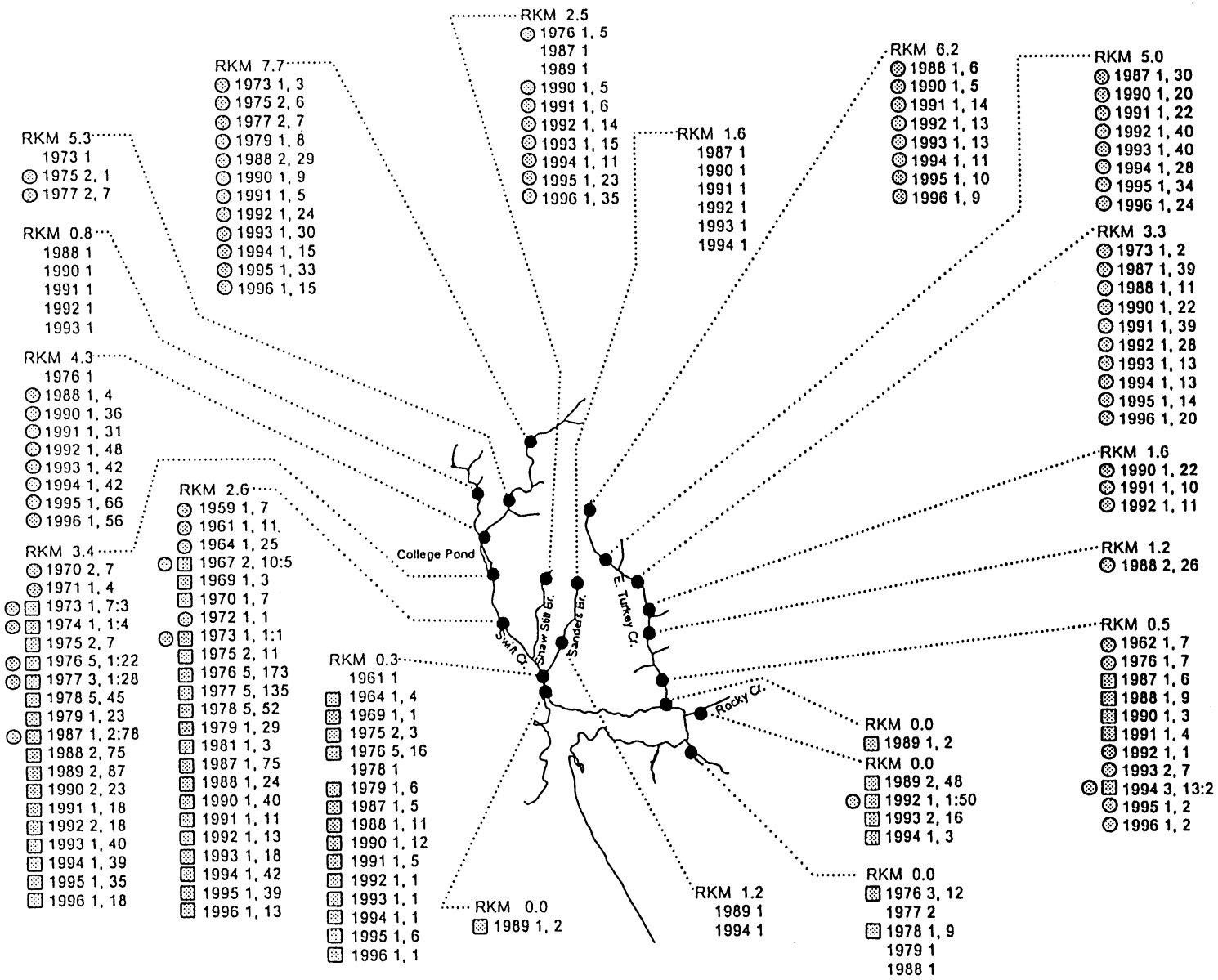
Okaloosa darters have only been found in the tributaries and main channels of Toms, Turkey, Mill, Swift, East Turkey, and Rocky Creeks. Approximately 90 percent of the 457-square kilometer (176 square miles) watershed drainage area is under the management of Eglin Air Force Base (Eglin AFB). They strive to maintain biological diversity and natural processes through an adaptive management program. The remainder of the watershed is in the urban complex of Niceville and Valparaiso (Fischer *et al.* 1994).

A geochronologic analysis of the genus *Etheostoma* in these streams was completed by Burkhead *et al.* (1994) to assess the distribution patterns of Okaloosa and brown darters (Figures 2, 3, and 4). The 705 collection records span 58 years of sampling and are maintained in a georeferenced database at the U.S. Geological Survey, Biological Resources Division in Gainesville, Florida (Mettee 1970; Crittenden 1974; Crews 1976a, b; Mettee and Crittenden 1977, 1978, 1979, 1980; Bortone 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996; Burkhead *et al.* 1994, Jordan and Jelks 1995, 1996, 1997). During the first collection review by Collette and Yerger (1962), the only darter known to co-occur with Okaloosa darters in the streams of Rocky and Boggy Bayous was the blackbanded darter, *Percina nigrofasciata*. Collette and Yerger (1962) were aware that, in some places, only a kilometer separated the headwater streams that contained both Okaloosa and brown darters, but these two species were not known to occur together at that time.

The brown darter ranges from the Perdido to the St. Johns Rivers in Florida, and north to below the fall line in Alabama and Georgia (Williams 1981). *Etheostoma edwini* is common in the Choctawhatchee and Yellow River systems, and in the smaller Garnier, Eagle, Trout, Basin, and Alaqua Creeks that drain into Choctawhatchee Bay. Thus, the brown darter is a widespread species in drainages that surround the streams containing the Okaloosa darter. Four other *Etheostoma* species, *E. colorosum*, *E. davisoni*, *E. fusiforme*, and *E. swaini*, are present in the Yellow and Choctawhatchee River systems, but are not found in the smaller Choctawhatchee Bay drainages.

In 1964, Mike Howell collected four brown darters from Swift Creek at the Florida Highway 20 bridge (Figure 3, RKM 0.3). It should be noted that these were the first *Etheostoma* ever collected at this site, and that Okaloosa darters have never been captured

Figure 3. The geochronology of the Okaloosa and brown darters from collections of the Swift Creek system, East Turkey (Bolton) Creek, the mouth of Rocky Creek, and an unnamed tributary to Rocky Bayou, Choctawhatchee Bay drainage, Florida. Solid circles reflect sampling site, while the digits following "RKM" refer to number of river kilometers to a confluence. The presence of Okaloosa darters (shaded circles) and brown darters (shaded squares) are followed by the year of collections, number of collections, and number of individuals collected, respectively (Okaloosa darters:brown darters).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1987 1
1989 1
1990 1, 5
1991 1, 6
1992 1, 14
1993 1, 15
1994 1, 11
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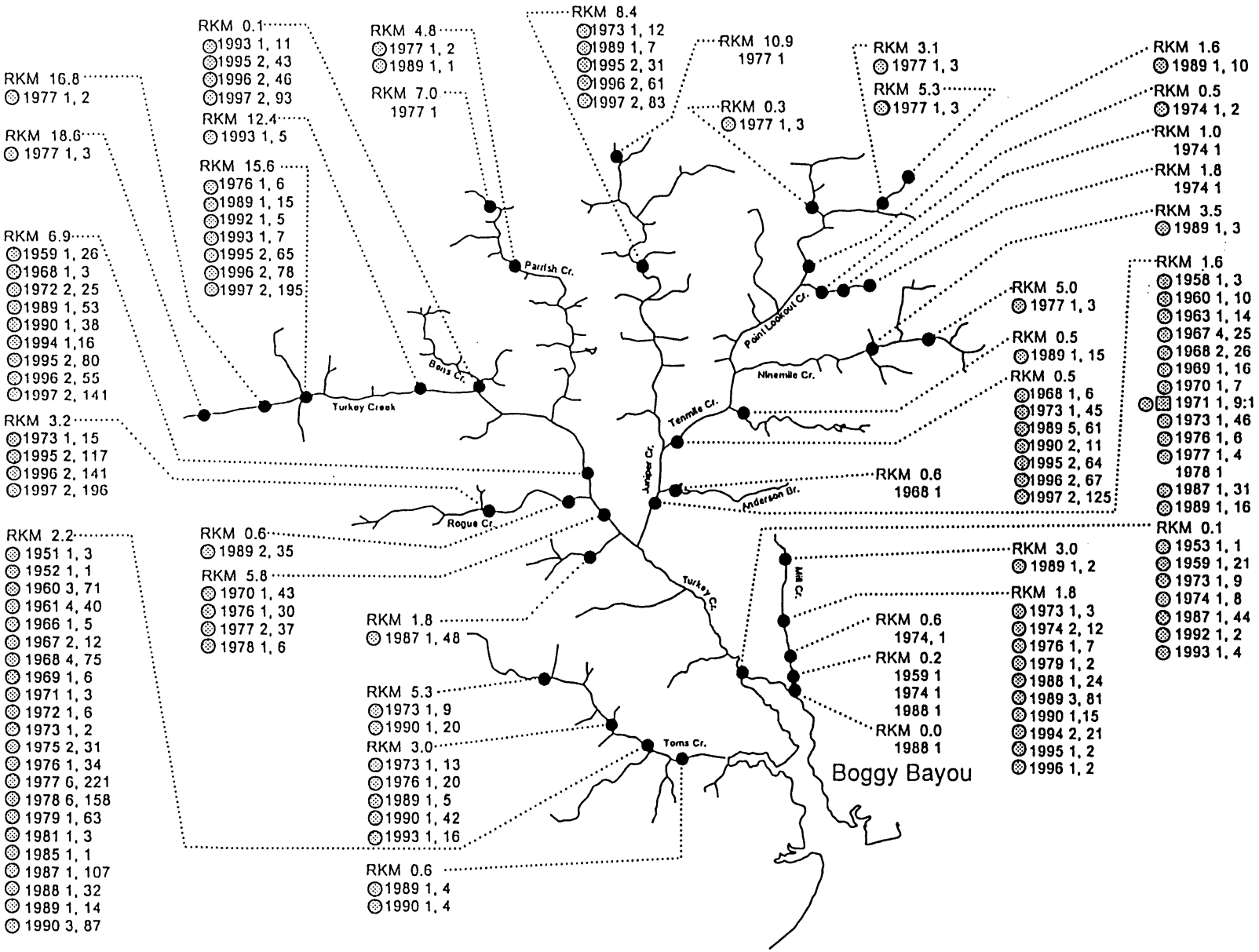
1996 1, 35
RKM 7.7
1973 1, 3
1975 2, 6
1977 2, 7
1979 1, 8
1988 2, 29
1990 1, 9
1991 1, 5
1992 1, 24
1993 1, 30
1994 1, 15
1995 1, 33
1996 1, 15
RKM 6.2
1988 1, 6
1990 1, 5
1991 1, 14
1992 1, 13
1993 1, 13
1994 1, 11
1995 1, 10
1996 1, 9
RKM 5.0
1987 1, 30
1990 1, 20
1991 1, 22
1992 1, 40
1993 1, 40
1994 1, 28
1995 1, 34
1996 1, 24
RKM 5.3
1973 1
1975 2, 1
1977 2, 7
RKM 1.6
1987 1
1990 1
1991 1
1992 1
1993 1
1994 1
RKM 3.3
1973 1, 2
1987 1, 39
1988 1, 11
1990 1, 22
1991 1, 39
1992 1, 28
1993 1, 13
1994 1, 13
1995 1, 14
1996 1, 20
RKM 0.8
1988 1
1990 1
1991 1
1992 1
1993 1
RKM 4.3
1976 1
1988 1, 4
1990 1, 36
1991 1, 31
1992 1, 48
1993 1, 42
1994 1, 42
1995 1, 66
1996 1, 56
RKM 1.6
1990 1, 22
1991 1, 10
1992 1, 11
RKM 2.6
1959 1, 7
1961 1, 11
1964 1, 25
1967 2, 10:5
1969 1, 3
1970 1, 7
1972 1, 1
1973 1, 1:1
1975 2, 11
1976 5, 173
1977 5, 135
1978 5, 52
1979 1, 29
1981 1, 3
1987 1, 75
1988 1, 24
1990 1, 40
1991 1, 11
1992 1, 13
1993 1, 18
1994 1, 42
1995 1, 39
1996 1, 13
RKM 1.2
1988 2, 26
College Pond
RKM 3.4
1970 2, 7
1971 1, 4
1973 1, 7:3
1974 1, 1:4
1975 2, 7
1976 5, 1:22
1977 3, 1:28
1978 5, 45
1979 1, 23
1987 1, 2:78
1988 2, 75
1989 2, 87
1990 2, 23
1991 1, 18
1992 2, 18
1993 1, 40
1994 1, 39
1995 1, 35
1996 1, 18
Swift Cr.
Shaw Sw Br.
Sandel Br.
E. Turkey Cr.
RKM 0.5
1962 1, 7
1976 1, 7
1987 1, 6
1988 1, 9
1990 1, 3
1991 1, 4
1992 1, 1
1993 2, 7
1994 3, 13:2
1995 1, 2
1996 1, 2
RKM 0.3
1961 1
1964 1, 4
1969 1, 1
1975 2, 3
1976 5, 16
1978 1
1979 1, 6
1987 1, 5
1988 1, 11
1990 1, 12
1991 1, 5
1992 1, 1
1993 1, 1
1994 1, 1
1995 1, 6
1996 1, 1
Rocky Cr.
RKM 0.0
1989 1, 2
RKM 0.0
1989 2, 48
1992 1, 1:50
1993 2, 16
1994 1, 3
RKM 0.0
1989 1, 2
RKM 1.2
1989 1
1994 1
RKM 0.0
1976 3, 12
1977 2
1978 1, 9
1979 1
1988 1

Figure 4. The geochronology of the Okaloosa and brown darters from collections of the streams of the Boggy Bayou system, Choctawhatchee Bay drainage, Florida. Solid circles reflect sampling site, while the digits following "RKM" refer to number of river kilometers to a confluence. The presence of Okaloosa darters (shaded circles) and brown darters (shaded squares) are followed by the year of collections, number of collections, and number of individuals collected, respectively (Okaloosa darters:brown darters).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1994 1,16
1995 2, 80
1996 2, 55
1997 2, 141
RKM 3.2
1973 1, 15
1995 2, 117
1996 2, 141
1997 2, 196
RKM 2.2
1951 1, 3
1952 1, 1
1960 3, 71
1961 4, 40
1966 1, 5
1967 2, 12
1968 4, 75
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1971 1, 3
1972 1, 6
1973 1, 2
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1976 1, 34
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1978 6, 158
1979 1, 63
1981 1, 3
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1988 1, 32
1989 1, 14
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1996 2, 46
1997 2, 93
RKM 12.4
1993 1, 5
RKM 15.6
1976 1, 6
1989 1, 15
1992 1, 5
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RKM 7.0
1977 1
RKM 8.4
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1989 1, 7
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RKM 10.9
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RKM 3.1
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RKM 1.6
1989 1, 10
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1958 1, 3
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1989 1, 16
RKM 5.0
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1989 1, 15
RKM 0.5
1968 1, 6
1973 1, 45
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1990 2, 11
1995 2, 64
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RKM 0.6
1968 1
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1989 2, 35
RKM 5.8
1970 1, 43
1976 1, 30
1977 2, 37
1978 1, 6
RKM 1.8
1987 1, 48
RKM 5.3
1973 1, 9
1990 1, 20
RKM 3.0
1973 1, 13
1976 1, 20
1989 1, 5
1990 1, 42
1993 1, 16
RKM 0.6
1989 1, 4
1990 1, 4
RKM 0.1
1953 1, 1
1959 1, 21
1973 1, 9
1974 1, 8
1987 1, 44
1992 1, 2
1993 1, 4
RKM 3.0
1989 1, 2
RKM 1.8
1973 1, 3
1974 2, 12
1976 1, 7
1979 1, 2
1988 1, 24
1989 3, 81
1990 1,15
1994 2, 21
1995 1, 2
1996 1, 2
RKM 0.6
1974, 1
RKM 0.2
1959 1
1974 1
1988 1
RKM 0.0
1988 1
Boggy Bayou
Parrish Cr.
Bens Cr.
Turkey Creek
Rogue Cr.
Point Lookout Cr.
Ninemile Cr.
Tenmile Cr.
Juniper Cr.
Anderson Br.
Turkey Cr.
Mill Cr.
Toms Cr.

there (Mettee 1970). It is unknown how and when brown darters arrived in Swift Creek. Some hypothesize that brown darters were released from bait-buckets by fishermen. Another possibility is intra-estuarine dispersal from Eagle Creek along the shoreline of Choctawhatchee Bay during periods of low salinity. A third hypothesis is that the brown darter has been present in the lower reaches of Rocky Bayou streams for a long period of time, but those areas were not sampled in earlier efforts, or the species was simply overlooked in those collections.

Although the origin source and arrival time are uncertain, the brown darter's ultimate success in Swift Creek below College Pond is well documented. College Pond Dam was constructed in 1968 when College Boulevard was paved (Mettee *et al.* 1976). Only two Okaloosa darters have been collected downstream of the pond since 1977, and these were captured with 78 brown darters in 1987 (Figure 3, RKM 3.4). Essentially, the brown darter has numerically replaced the Okaloosa darter below the pond. This pattern contributed to the concern that the brown darter might eventually out-compete the Okaloosa darter to the point of extinction (Mettee *et al.* 1976; Britt *et al.* 1981). Above College Pond, however, brown darters have never been collected while Okaloosa darters remain common (Figure 3, RKM 4.3, 5.3, 7.7). It should also be noted that Okaloosa darters are the only *Etheostoma* collected in Shaw Still Branch, a tributary that joins Swift Creek over 2 km below College Pond (Figure 3, RKM 2.5).

There is a 3-meter vertical drop from College Pond to the Swift Creek outlet. It has been suggested that this physical barrier prevents brown darters from moving upstream (Mettee *et al.* 1976). One could also surmise that the pond and spillway prevent Okaloosa darters from moving downstream. The pond and dam have affected water quality in the lower reach of Swift Creek. The highest and lowest temperatures (35.5°C and 7°C, respectively) of any sampling sites in the database were measured at Swift Creek below the dam. Higher water conductivity (120 micromhos/centimeter) was measured at this site than in any other stream section sampled. These conditions may favor the brown darter over the Okaloosa darter.

Following the discovery of brown darters in Swift Creek, *E. edwini* were collected in Rocky Creek (Figure 2, RKM 11.1) in 1968, an unnamed creek in the southeast section of Rocky Bayou (Figure 3, RKM 0.0) in 1976, and East Turkey (Bolton) Creek (Figure 3, RKM 0.5) in 1987. This apparent expansion of the brown darter into what was considered allopatric (only one species) Okaloosa darter streams caused some researchers to predict that the brown darter posed a biological threat to the Okaloosa darter through competitive interactions (Mettee *et al.* 1976). Besides the two stations in Swift Creek below the dam (Figure 3, RKM 2.6, 3.4), there are only nine sites in the Rocky Bayou system where Okaloosa darters were collected prior to brown darters: East Turkey (Bolton) Creek (Figure 3, RKM 0.5), West Long Creek (Figure 2, RKM 3.1, 5.5), Little Rocky Creek (Figure 2, RKM 4.0), Rocky Creek (Figure 2, RKM 11.1, 18.7), Schoolhouse Branch (Figure 2, RKM 1.1), East Rocky Creek (Figure 2, RKM 0.2), and

East Long Creek (Figure 2, RKM 4.7). In the most recent collections, seven of these sites were allopatric with *E. okaloosae*, while the other two were sympatric (both species present). Forty-one sites in the Rocky Bayou system have only *E. okaloosae* records, while 22 sites had some brown darters in the initial collection (Figures. 2 and 3). Of the 22 sites with brown darters, six were consistently allopatric brown; seven remain sympatric; two went from sympatric to allopatric Okaloosa; and the remaining seven sites fluctuated between sympatric and allopatric brown.

In general, Okaloosa darters are distributed allopatrically in headwater streams of Rocky Bayou, while the brown darter becomes more prevalent toward the mouth. The only exception to this pattern is the anomalous single brown darter caught in the extreme northeast part of the system (Figure 2, RKM 0.1). This unnamed tributary to Rocky Creek has a pond where a bait-bucket release is probable. With the exception of Swift Creek below College Pond, there is no consistent trend of brown darters replacing Okaloosa darters. As the above examples illustrate, there tend to be fluctuations in the ratio of the two species in the lower reaches of the Rocky Bayou drainage. To date, there have been no reports of hybridization between the two species.

With one exception, the Okaloosa darter is completely allopatric in the Boggy Bayou stream systems. Only one brown darter was ever collected in 113 collections within this drainage. This individual was captured with nine *E. okaloosae* in Juniper Creek at the Florida Highway 85 bridge (Figure 4, RKM 1.6). This site is near Anderson Pond, a popular fishing location at Eglin AFB. This collection record might be additional evidence supporting the bait-bucket release hypothesis.

Figure 5 summarizes figures 2 to 4 showing that Okaloosa darters occupy headwater streams exclusively and all of the Boggy Bayou streams, while brown darters tend to occupy the lower reaches of Rocky Bayou streams. Areas of sympatry (both species present at any collection) fluctuate in the ratios of the two species.

After considering all of the geochronology data on Okaloosa and brown darters, there is evidence supporting all three theories proposed for the presence of the brown darter. The two anomalous and isolated records of brown darters in the Boggy Bayou system and in the headwaters of Rocky Creek support the notion that bait-bucket releases of darters may be occurring. The lack of collections at many of the sites where brown darters eventually were found is an example of the tendency for ichthyologists to repeatedly collect at type localities and known stations. If collections had been made in the 1950s of the lower reaches of Swift Creek, we might know if the Okaloosa darter was there prior to the brown darter. The theory of intra-estuarine dispersal may have the most supporting evidence.

Brown darters were able to tolerate salinities typical of Choctawhatchee Bay in laboratory experiments (Burkhead *et al.* 1994). Adult brown darters tolerated up to 14 parts per

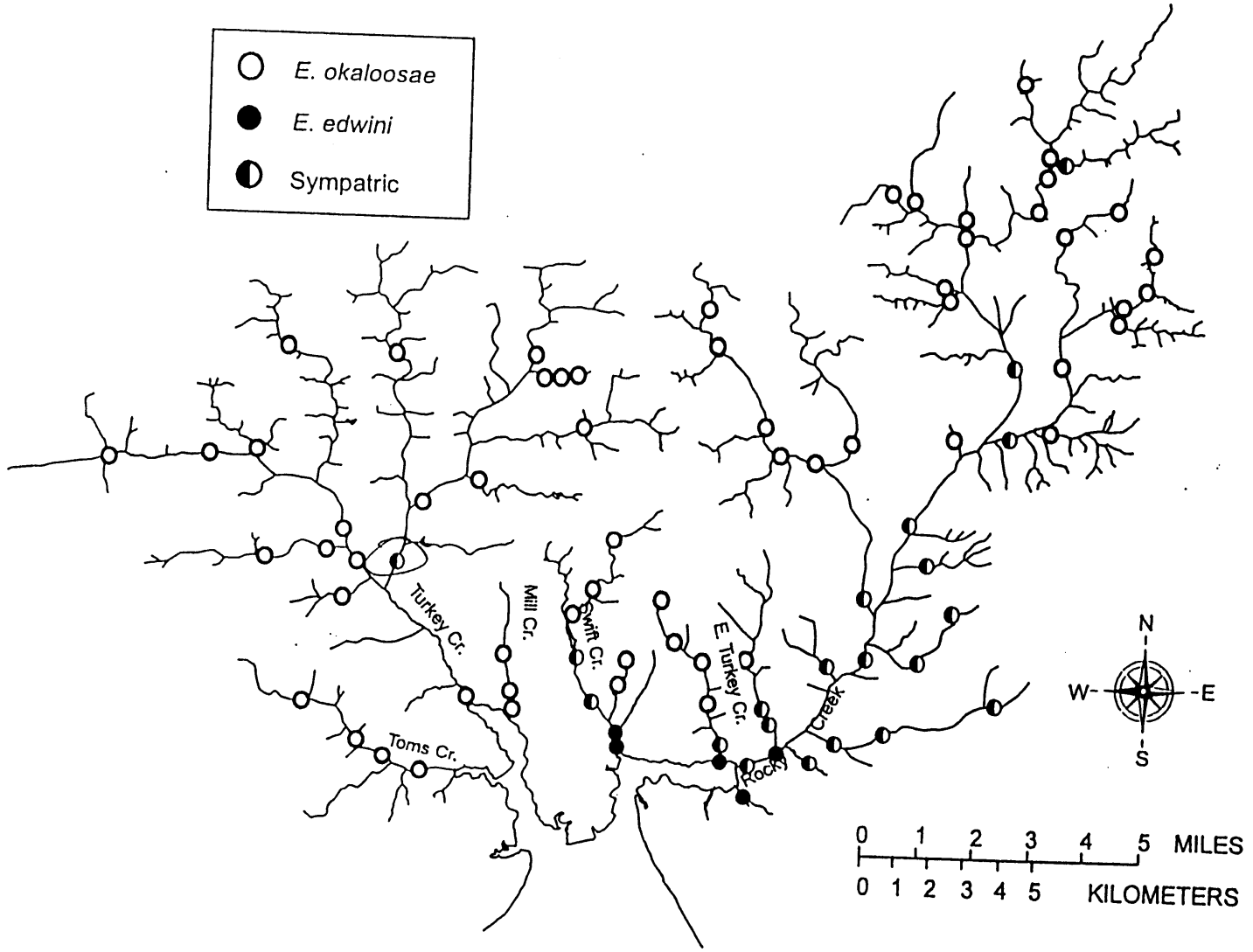

Figure 5. The distribution of Okaloosa and brown darters in the six stream systems of Boggy and Rocky Bayous. Open circles indicate sites where only Okaloosa darters (*E. okaloosae*) have been found, while shaded circles indicate brown darter sites (*E. edwini*). Circles that are half shaded indicate sites where at least one brown darter was collected together with Okaloosa darters (Sympatric).

thousand (‰) salinities in acute tests and experienced 96 percent survivorship after 25 days at 10‰. Salinities along the periphery of Choctawhatchee Bay range from zero to 24‰, with an average of 10‰ (unpublished data for 1985-86, Northwest Florida Water Management District). The extreme flood of the Choctawhatchee River in March 1929 may have introduced the brown darter to the Rocky Bayou system from adjacent streams (United States Department of Agriculture 1975).

Although the exact method and timing of brown darter colonization will probably never be known, brown darters seem to occur where the Okaloosa darter formerly did when stream conditions change, as they did in lower Swift Creek. As streams flow through the landscape, their physical, chemical, and biological characteristics change. In the Rocky Bayou system, these subtle, gradual, changes are associated with increases in the prevalence of brown darters. It is possible that higher ratios of runoff to sand-filtered groundwater is what encourages brown darters at the expense of Okaloosa darters. A geomorphology study of Eglin AFB found that sub-surface clay layers in the middle and lower reaches of the Rocky Creek system decrease water infiltration rates, thus increasing drainage density (length of streams per area) and amount of surface runoff (Barr *et al.* 1985; Fischer *et al.* 1994).

C. Habitat/Ecosystem/Life History

Longleaf pine-wiregrass-red oak sandhill communities dominate the vegetation landscape in Okaloosa darter watershed basins. These areas are characterized by high sand ridges where soil nutrients are low and woodland fire is a regular visitor. Where water seeps from these hills, acid-bog communities of sphagnum moss, pitcher plants and other plants adapted to low nutrient soils develop. In other areas, the water emerges from seepage springs directly into clear-flowing streams where variation of both temperature and flow is moderated by the deep layers of sand. The streams support a mixture of bog moss (*Mayaca fluviatilis*), bulrush (*Scirpus etuberculatus*), golden club (*Orontium aquaticum*), burr-weed (*Sparganium americanum*), pondweed (*Potamogeton diversifolius*), spikerush (*Eleocharis* sp.) and other aquatic and emergent plants.

The areas inhabited by the Okaloosa darter are typically the margins of flowing streams where detritus, root mats, and vegetation are present. Densities average about one darter in every 2.7 meters of stream length (Burkhead *et al.* 1994). Okaloosa darters have not been collected in areas where there is no current nor have they been collected in the open, sandy areas in the middle of stream channels. Brown darters also occupy similar stream margins; however, they are capable of living in areas of little to no flow (Burkhead *et al.* 1994). Okaloosa darters feed primarily on fly (Diptera), mayfly (Ephemeroptera), and caddis fly (Trichoptera) larvae (Ogilvie 1980). The breeding season extends from late March through October, although it usually peaks in April. Spawning pairs have been videographed attaching one or two eggs to vegetation, and they also have been observed attaching eggs to woody debris and root mats (Burkhead *et al.* 1994; Collette and Yerger

1962). Ogilvie (1980) found a mean of 76 ova and 29 mature ova in 201 female Okaloosa darters. These numbers may under-represent annual fecundity as the prolonged spawning season is an indication of fractional spawning (i.e., eggs develop and mature throughout the spawning season). Estimates of longevity range from two to three years (Burkhead *et al.* 1992; Mettee and Crittenden 1979; Ogilvie 1980).

D. Reasons for Listing and Present Threats

The Okaloosa darter was initially listed because of its extremely limited range and potential problems resulting from erosion, water impoundment, and competition with brown darters. Since the listing in 1973, several stream sections have either decreased population levels or Okaloosa darters are no longer found at all. In Swift Creek, downstream of College Pond, no Okaloosa darters have been caught since 1987. Mill Creek has lost much of its Okaloosa darter habitat to erosion, culverting, and beaver ponds associated with culverts. Populations, however, appear stable in the upper reaches of the Boggy and Rocky Bayou stream systems since monitoring began in 1995.

Eglin AFB has maintained its system of roads by mining clay and sand from 144 pits of various sizes (Eglin 1993). Thirty-nine of these pits are located within or immediately adjacent to Okaloosa darter drainages. Ten of these pits are still active. These pits have been sites of extreme erosion where stream vegetation was entombed beneath sediments. The roads have also been sources of excessive sedimentation.

Sand-filtered groundwater, the primary source for Okaloosa darter streams, is susceptible to reduced contributions as the amount withdrawn from the sand-gravel aquifer increases (Barr *et al.* 1985). Increases in impermeable surfaces in the urban areas cause increased surface runoff with associated fluxes in water temperature and chemistry. Finally, the potential for catastrophic spills of toxic substances increases as traffic across Okaloosa darter streams expands in volume and extent.

E. Conservation Measures

It is imperative that the management of the lands and waters of the drainage area maintain conditions that support Okaloosa darters. Managing the landscape with techniques that preserve natural processes in the ecosystem (i.e., fire, flood, sediment transport, vegetation succession) will help ensure the continued existence of the Okaloosa darter and avoid range expansion of the brown darter.

The potential for maintaining favorable conditions for the Okaloosa darter is high because over 90 percent of the drainage area of the Okaloosa darter streams is managed by Jackson Guard Natural Resource Branch of Eglin AFB. The darter population has persisted through drought conditions in 1984, hurricanes in 1995, and severe erosion problems in the watersheds. Eglin AFB strives to improve their resource stewardship

through an adaptive ecosystem management process (Eglin 1993). Currently, projects to restore clay borrow pits, correct road erosion, and close nonessential roads have improved Okaloosa darter stream habitat by reducing sediment scouring and entombment of submerged vegetation. Eglin AFB has committed over 3.6 million dollars since 1994 to restoring 20 pits and 57 non-point erosional sources. These actions resulted in an estimated 15,500 ton annual reduction in sediments flowing into darter streams.

Eglin AFB has designated an Okaloosa Darter Management Emphasis Area that includes the drainages of all six Okaloosa darter streams. The goals of this effort are to (1) stabilize and increase the Okaloosa darter population, (2) prevent or significantly reduce erosion from degrading Okaloosa darter habitat, and (3) identify and modify road culverts which have resulted in stream gradients detrimental to Okaloosa darters.

Eglin AFB has consistently funded research on the ecology of the Okaloosa darter and long-term monitoring of darter populations. Educational brochures and signs have been prepared with the assistance of the University of Florida, and public surveys have tested their effectiveness.

The following outline details specific tasks identified in the 1981 Okaloosa Darter Recovery Plan and the progress made on each.

I. Determine biological characteristics and habitat requirements.

I-1. Determine optimum habitat of the Okaloosa darter.

I-1-A. Determine distribution. **The U.S. Geological Survey Biological Resources Division, Florida Caribbean Science Center (USGS) maintains a geochronology database of over 700 collection records.**

I-1-B. Determine reproduction, growth, feeding, and other life history aspects. **Florida Game and Fresh Water Fish Commission, USGS, and the Service have reports that were used in developing the habitat/ ecosystem/life history section of this plan.**

I-1-C. Determine physical parameters of Okaloosa darter streams. **USGS and the Service are currently investigating stream temperature and other water quality parameters. Okaloosa-Walton Counties have ongoing water quality studies in association with treated sewage sprayfields. The Northwest Florida Water Management District (NWFWMD) and USGS Water Resources Division water gauging station on Juniper Creek that started collecting surface flow data in**

1966 was removed in 1992. Eglin AFB funded Resource Consultants and Engineers to study the geomorphology of Okaloosa darter streams.

I-2. Determine potential hazards to the Okaloosa darter.

I-2-A. Define any competitors and predators. The role of the brown darter as a competitor has been investigated in the field by USGS. Fish predators have not changed from those encountered in the past.

I-2-B. Monitor sympatric populations of Okaloosa and brown darters. Eglin AFB, USGS, the Service, and the University of West Florida are all involved in darter monitoring.

I-2-C. Monitor habitat modification. Eglin AFB has developed a geographic information system to track habitat restoration while USGS monitors stream sites for changes in stream habitat.

I-3. Determine population size and fluctuations of the Okaloosa darter.

I-3-A. Conduct population studies. Same as I-2-B.

I-3-B. Determine fluctuations of populations by periodic sampling. Same as I-2-B.

II. Protect extant populations and habitats.

I-1. Define permissible and prohibited activities in Okaloosa darter habitats. The Service has done several consultations under Section 7 of the Endangered Species Act with Eglin AFB, U.S. Army Corps of Engineers, and Florida Department of Transportation to protect Okaloosa darter habitat.

II-2. Reduce possible competitors and predators. This task has not been deemed necessary at this time.

II-3. Investigate need for land acquisition. Since 90% of the watershed area is under federal ownership, additional land acquisition has not occurred.

III. Increase Okaloosa darter populations and reestablish range.

III-1. Create more optimum habitat by manipulating physical parameters. Ongoing erosion abatement by Eglin AFB is associated with increased numbers of darters.

III-2. Reestablish extirpated populations with transplants. **As we have not lost any stream populations to date, there has not been a need for captive propagation and release. If the situation occurs, the revised plan includes a catastrophe prevention and response plan.**

The Okaloosa darter population appears to be stable or increasing at most of the sites from 1995 to 1998 and comprised of two plus age-classes. Sites that have low or decreasing numbers of darters have identified threats that can be alleviated (i.e., impoundment, sedimentation and golf course runoff). If these situations improve and no new problems arise then the Okaloosa darter will be a candidate for downlisting after completing five years of population monitoring in 2001.

PART II

RECOVERY OUTLINE

A. Objective and Criteria - The objective of this Recovery Plan is to restore and protect Okaloosa darter habitat and stream ecosystems so that the Okaloosa darter may be initially downlisted and eventually delisted. The Okaloosa darter only occupies the unique habitats of six stream systems, and recovery tasks are focused on habitats within their historic range. All recovery criteria are preliminary and may be revised on the basis of new information (including research specified as recovery tasks).

The Okaloosa darter will be considered for reclassification from endangered to threatened in 2001, if:

1. Instream flows and historical habitat of stream systems have been protected through management plans, conservation agreements, easements, and/or acquisitions;

2. Eglin Air Force Base has and is implementing an effective habitat restoration program to control erosion from roads, clay pits, and open ranges;

3. Okaloosa darter population is stable or increasing and comprised of two plus age-classes, in all six stream systems for 5 consecutive years (see Appendix A for definition and methods);

4. The range of the Okaloosa darter has not decreased at all historical monitoring sites; and

5. No foreseeable threats exist that would impact the survival of the species.

The Okaloosa darter will be considered for delisting when: [Note: Goal may not be achievable with significant changes in military mission.]

1. A. All reclassification criteria have been met;

   B. Historic habitat of all six streams has been restored to support viable populations of Okaloosa darters (including degraded sections of Mill, Swift, and Toms Creeks);

   C. Erosion at clay pits, road crossings, and steep slopes has been minimized to the extent that resemble historic predisturbance condition;

D. Longleaf restoration and watershed management practices on Eglin AFB are in effect;

E. Natural, historical flow regimes are maintained; and

F. Water quality and riparian habitat have been significantly improved and maintained.

2. A. Cooperative and enforceable agreements are in place to protect habitat, water quality and quantity for the historic range outside of Eglin AFB; and

B. Management plans that protect and restore habitat, water quality and quantity have been effective and are still in place for the 90 percent of the historic range currently managed by Eglin AFB.

3. Okaloosa darter populations at monitoring sites consist of two plus age-classes remained stable or increasing in all six streams over a period of 20 consecutive years (see Appendix A for definition and methods); and

4. No foreseeable threats exist that would impact the survival of this species (assumes military mission is compatible).

B. Narrative Outline

1. Restore and protect habitat in the six Okaloosa darter stream watersheds. The Okaloosa darter is restricted in distribution to six streams of which about 90 percent of the basins are on Eglin AFB and the remaining 10 percent in the Niceville and Valparaiso municipal area. Because of the specific habitat requirements and limited distribution of the darter, habitat which is essential for spawning, rearing, feeding, and cover needs to be restored and protected to prevent the species from declining irreversibly and to recover the species.

   1.1 Continue to restore habitat on Eglin AFB by implementing erosion and sediment control measures. Continue best watershed management practices and longleaf pine ecosystem restoration. Managing the landscape with techniques that preserve natural processes (i.e., fire, flood, sediment transport, and vegetation succession in riparian and upland zones) will help ensure the continued existence of the Okaloosa darter.

      1.1.1 Apply erosion and sedimentation control measures at clay pits, road crossings, open ranges, and steep slopes within the Okaloosa darter watershed. This is a continuation of an active erosion control program involving site restoration, revegetation, and road access control.

         1.1.1.1 Continue the restoration of clay pits and road crossings throughout Okaloosa darter watersheds.

         1.1.1.2 Continue road access control program that reduces erosion and the number of sites where contaminants or nonindigenous species might be introduced to stream systems.

         1.1.1.3 Widen riparian buffers in open ranges of Eglin AFB to the normal hill crest so that mission visibility will not be impaired, and darter habitat will be improved.

         1.1.1.4 Apply best management practices to road construction and maintenance.

   1.2 Improve Mill Creek habitat to increase the very low darter population remaining there. Because of the small size of this creek and the golf course and urban impacts it receives, the population of darters in Mill Creek is the most imperiled. Okaloosa darters in Mill Creek may

represent robust strain that is important to the long-term survival of the species. In case of a catastrophic event, having multiple streams populated with Okaloosa darters decreases the probability of extinction.

1.2.1 Stabilize headwater banks on the golf course.

1.2.2 Remove impediments to flow such as sediment beds, beaver dams, and clogged culverts.

1.2.3 Minimize the use of pesticides, herbicides, and other contaminants on the golf course that impact Mill Creek darters by developing and implementing a chemical use plan.

1.2.4 Restore open channel stream habitat between State Routes 190 and 20 by converting underground piped and beaver ponded segments into free flowing streams.

1.3 Evaluate the effects of ponds on Okaloosa darters and make ecological restoration recommendations. Improve stream habitat by modification or removal of water control structures where appropriate. Effects to consider include, but are not limited to, potential blockage to emigration and genetic mixing of Okaloosa darters, introduction of contaminants and nonindigenous species at ponded sites, downstream water quality problems, and loss of suitable habitat.

1.3.1 Evaluate Eglin AFB ponds for ecological restoration.

1.3.2 Evaluate and modify the spillway of College Pond on Swift Creek to improve water quality below the dam.

1.4 Incorporate Okaloosa darter habitat conservation and restoration measures in Eglin AFB Natural Resources Management Plan. The Sikes Act (Public Law 86-797, as amended) provided for cooperation by the Departments of the Interior and Defense with State agencies in planning, development, and maintenance of fish and wildlife resources on military reservations. Natural resource management plans developed by Eglin AFB will be reviewed by the Service for the sound management of the Okaloosa darter as part of the ecosystem. Actions taken to benefit the darter will be evaluated for effectiveness.

1.5 Prepare an Okaloosa darter habitat catastrophe response plan. The plan should be implemented if necessary to ensure the continued survival of this species if a short-term catastrophe occurs. If a segment of Okaloosa

darter stream habitat is destroyed in a catastrophic event and appropriate sampling indicates that Okaloosa darters have been extirpated, then Okaloosa darters may be re-introduced once sufficient habitat has been restored. Habitat should be restored using native vegetation while re-introduced darters should be from the closest viable population that can donate fish to preserve the local genetic strain. Captive breeding will be utilized as a part of this recovery effort only if a major perturbation makes such an action necessary to ensure the continued survival of the species.

1.6 Ensure that the design and construction of roads outside of Eglin AFB use best management practices to reduce erosion of embankments, stormwater runoff, and floodplain structures in Okaloosa darter watersheds. County and municipal governments should work with the Florida Department of Transportation to accomplish this task.

1.7 Include conservation actions for Okaloosa darters in the comprehensive plans of surrounding communities. Assist city (Niceville, Valparaiso) and county (Okaloosa, Walton) government agencies to incorporate best management practices in their planning so that conflicting use of aquatic resources can be avoided. Currently, these communities have developed Comprehensive Plans to provide buffers along creeks. Additional sections should address erosion, buffer maintenance, stormwater retention, and planned water usage and withdrawals. The Panama City field office of the Service will review comprehensive and development site plans for relevance to Okaloosa darter recovery objectives.

1.8 Develop cooperative ventures with private landowners to restore habitat. The Service as well as other State and Federal agencies in cooperation with willing landowners, have begun to implement programs to restore, enhance, and manage aquatic habitats on private lands.

2. Protect water quality and quantity in Okaloosa darter streams. Other than Swift and Mill Creeks, most of the Okaloosa darter streams have relatively stable, viable populations of darters. About 90 percent of the 51,397 hectares (127,000 acres) that represent the drainage basins of darter streams are managed by the Jackson Guard Natural Resource Division of Eglin AFB. The remaining 485.6 hectares (12,000 acres) are situated in the Niceville-Valparaiso urban complex. Okaloosa darters are found at reduced levels or absent from much of this latter area. Current stream impacts include erosion, non-point discharge of nutrients and pollutants, impoundment, alteration of flow, and culverting. The tenuous balance between Okaloosa and brown darter may hinge on water quality. It is imperative that management of the lands and waters of the area maintain conditions in the headwaters so Okaloosa darter is not replaced by brown darter.

2.1 Incorporate water quality and quantity conservation into natural resource management plans for Eglin AFB to benefit Okaloosa darters and stream ecosystems.

2.2 Ensure that water quality criteria established by the Florida Department of Environmental Protection (FDEP) are protective of Okaloosa darters and their habitat so that the recovery is not impaired by any permitted activity. Identified concerns include, but are not limited to, treated wastewater discharge, stormwater runoff, landfill leaching, and adverse impacts on the sand-gravel aquifer.

2.3 Ensure that flow volumes and regimes continue to resemble historic conditions. The Okaloosa darter is restricted to six streams that are hydrologically linked to the sand-gravel aquifer and the amount of darter habitat is dependent on the volume of water flowing down these streams. During drought condition the darter population will experience stress that should not be increased by human use of the resource. Unfortunately, human needs for water use are highest during droughts. Establish agreements between NWFWMD and the Service to specify a threshold level of consumption at which applications for consumptive water use permits within the drainage basins of Okaloosa darter streams will be reviewed for potential adverse impacts.

3. Monitor and annually assess darter populations, habitat conditions, water quality, and water quantity of the recovery program and recommend new actions.

3.1 Monitor populations and habitat conditions of Okaloosa and brown darters. During and after recovery actions are implemented, the status of the species and its habitat must be monitored to assess any progress towards recovery. Monitoring data are necessary to determine whether or not recovery criteria for reclassification and delisting have been met. Continued monitoring of the two darter species will provide understanding of the periodicity, magnitude, and causal factors of population fluctuations in zones of sympatry.

3.1.1 Darter population monitoring methods should be standardized and comparable with the efforts of the USGS, Biological Resources Division and University of West Florida so that long-term trends can be quantitatively analyzed (see Appendix A for methods).

3.1.2 Establish new darter monitoring stations at sites where habitat has been restored.

3.1.3 Link darter habitat conditions to the population monitoring by using a geographical information system (GIS) to document changes in land use, water quality and quantity, fire periodicity, vegetation cover, restoration of erosional sites, and natural fluvial processes. Data being compiled for Eglin AFB need to be expanded to include the entire watershed.

3.2 Monitor water quality. Water quality parameters (temperature, conductivity, dissolved oxygen, turbidity, pH, total dissolved solids, total suspended solids, nutrients and other contaminants) will be measured at wastewater treatment facilities, golf courses, sanitary landfills, and other point discharge locations. Data will be reviewed by the Service for adverse trends.

3.2.1 Investigate the load of nutrients and contaminants from golf course by studying chemical use needs and using indicator aquatic insect surveys.

3.2.2 Inventory pollutants on Eglin AFB that affect darter streams to determine toxicity potential and consider alternatives.

3.2.3 The Service will review the 305(b) report developed by the Florida Department of Environmental Protection for status and trends of water quality.

3.3 Monitor water quantity.

3.3.1 Monitor groundwater wells in the Okaloosa darter drainage basins. The NWFWMD currently monitors a groundwater well network on Eglin AFB. Continuation of this monitoring will help predict cone-depression profiles in the sand-gravel aquifer as new wells are installed or old wells increase pumpage rates.

3.3.2 Re-establish surface water flow monitoring. Seven surface water stations were maintained in Okaloosa darter streams by the NWFWMD and the USGS Water Resources Division. Re-establishing two of these is necessary for monitoring flows of streams. The station at the State Route 85 bridge over Juniper Creek has the longest record of surface flows (1966-1992) in the immediate area and should be given the highest priority. An additional station in the Rocky Creek system would also be important.

3.4 Annually assess the overall success of the recovery program and recommend action (changes in recovery criteria, status classification, protection measures, new research studies, etc.). The recovery plan must be evaluated periodically to determine if it is on track and to recommend future actions. As more is learned about the species, the recovery objectives may need to be modified.

4. Establish a public information and education program and monitor its effectiveness. Public awareness of the species is essential to the long-term success of recovery efforts. Informative posters, brochures, slide shows, videos, and other outreach materials and efforts will help focus attention on the uniqueness of the Okaloosa darter and describe its habitat requirements. These materials will be available at canoe landings, golf courses, municipal buildings, school systems, public libraries, Jackson Guard Natural Resource Division headquarters, etc.

4.1 Develop a fact sheet on the survival and recovery needs of the Okaloosa darter for distribution to the local community.

4.2 Summarize best management practices for golf course operation that are important to the survival and recovery of the Okaloosa darter in Mill Creek. Encourage that all new golf course personnel be trained on these practices and the activities that could potentially result in a violation of Section 9 under the Endangered Species Act.

4.3 Provide periodic reminders to Federal, State, and local agencies to continue to incorporate Okaloosa darter recovery actions into local planning activities.

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PART III

IMPLEMENTATION SCHEDULE

Task priorities in column one of the following Implementation Schedule are assigned as follows:

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to meet the recovery objectives.

Key to Acronyms Used in this Implementation Schedule

BRD - Biological Resources Division, U.S. Geological Survey
COE - United States Army Corps of Engineers
EGLIN - Jackson Guard Natural Resource Branch of Eglin Air Force Base
ES - Ecological Services Division of the U.S. Fish and Wildlife Service
FDEP - Florida Department of Environmental Protection
FDOT - Florida Department of Transportation
FGFWFC - Florida Game and Fresh Water Fish Commission
FWS - United States Fish and Wildlife Service
NICE - City of Niceville
NWFWMD - Northwest Florida Water Management District
OKA - Okaloosa County
USDA - United States Department of Agriculture
SUS - State University System
VALP - City of Valparaiso
USGS - United States Geological Survey
WAL - Walton County
* = Lead Agency

OKALOOSA DARTER IMPLEMENTATION SCHEDULE

Priority	Task Number	Task Description	Task Duration	Responsible Agency FWS	other	Cost Estimates ($000's) FY1	FY2	FY3	FY4	FY5	Comments
1	1.2.3	Minimize use of contaminants on Golf Course.	ongoing		EGLIN*	2	2	2	2	2	
1	2.3	Establish consumptive use permit agreements.	2 years	ES	NWFWMD*	1	1	0	0	0	
2	1.1.1.1	Abate erosion program on Eglin AFB.	ongoing		EGLIN*	900	700	500	300	300	
2	1.1.1.2	Control road access on Eglin AFB.	ongoing		EGLIN*	15	10	5	5	5	
2	1.1.1.3	Widen riparian buffers in open ranges of Eglin AFB.	ongoing		EGLIN*	25	15	10	5	5	
2	1.1.1.4	Use road BMPs on Eglin.	ongoing		EGLIN*	5	5	5	5	5	
2	1.2.1	Stabilize headwater banks on Golf Course.	2 years		EGLIN*	20	20	0	0	0	
2	1.2.2	Remove impediments to flow in Mill Creek.	2 years		EGLIN*, COE, OKA WAL	15	10	0	0	0	
2	1.2.4	Create open channel in Mill Creek.	3 years		EGLIN*	50	40	30	0	0	

Implementation schedule continued on next page

Priority	Task Number	Task Description	Task Duration	Responsible Agency FWS	other	Cost Estimates ($000's) FY1	FY2	FY3	FY4	FY5	Comments
2	1.3.1	Evaluate and restore Eglin AFB ponds.	3 years		EGLIN* BRD	5	5	5	0	0	
2	1.3.2	Evaluate and modify College Pond spillway.	2 years	ES	FDOT*, OKA, WAL, NICE, BRD	0	1	20	0	0	
2	1.4	Include habitat conservation and restoration measures in Natural Resource Management Plan.	ongoing	ES	EGLIN*	1	1	1	1	1	
2	1.6	Review BMPs for roadways outside of Eglin.	1 year	ES	FDOT*, OKA, WAL, NICE, VALP	3	0	0	0	0	
2	1.7	Include conservation actions in comprehensive plans.	ongoing	ES	OKA*, WAL*, NICE*, VALP*	1	1	1	1	1	
2	2.1	Address water quality and quantity to Natural Resources Plans at Eglin.	ongoing	ES	EGLIN*, BRD	1	1	1	1	1	
2	2.2	Establish protective water quality criteria .	2 years	ES	FDEP*	1	1	0	0	0	
2	3.1.1	Monitor darter populations.	ongoing	ES	BRD*, SUS, EGLIN, FGFWFC	30	30	30	30	30	

Implementation schedule continued on next page

Priority	Task Number	Task Description	Task Duration	Responsible Agency FWS	other	Cost Estimates ($000's) FY1	FY2	FY3	FY4	FY5	Comments
2	3.1.2	Monitor darters at habitat restoration sites.	ongoing	ES	EGLIN*, BRD	10	10	10	10	10	
2	3.1.3	Analyze habitat by GIS.	ongoing	ES	EGLIN*, BRD	50	50	50	50	50	
2	3.2.1	Investigate nutrient and contaminant loads from golf course.	ongoing	ES	EGLIN*	2	2	2	2	2	
2	3.2.2	Inventory of pollutants on Eglin .	ongoing	ES	EGLIN*	2	2	2	2	2	
2	3.2.3	Maintain status and trends of water quality .	ongoing	ES*	EGLIN, FDEP, OKA, WAL	2	2	2	2	2	
2	3.3.1	Continue groundwater monitoring.	ongoing		NWFWMD*, EGLIN, USGS	8	8	8	8	8	
2	3.3.2	Re-establish surface water flow monitoring.	ongoing	ES	NWFWMD*, USGS, EGLIN	30	15	15	15	15	
2	3.4	Assess darter recovery annually.	ongoing	ES*	BRD, EGLIN	2	2	2	2	2	
3	1.5	Prepare catastrophe response plan.	1 year	ES	EGLIN*, BRD	3	0	0	0	0	
3	1.8	Initiate cooperative agreements with private landowners.	2 years	ES*	USDA	10	10	0	0	0	

Implementation schedule continued on next page

Priority	Task Number	Task Description	Task Duration	Responsible Agency FWS	other	Cost Estimates ($000's) FY1	FY2	FY3	FY4	FY5	Comments
3	4.1	Prepare public education fact sheet on darter.	5 years	ES	BRD*, NICE, VALP, OKA, WAL, SUS FGFWFC, EGLIN	1	1	1	1	1	
3	4.2	Summarize BMPs for golf course operations.	ongoing	ES	EGLIN*	1	1	1	1	1	
3	4.3	Remind involved agencies to incorporate recovery actions into local planning activities.	ongoing	ES*	BRD	0		0	0	0	

APPENDIX A

POPULATION STABILITY STANDARDIZED SAMPLING METHODOLOGY FOR OKALOOSA DARTER (*Etheostoma okaloosae)* --- MAY 1998

Recovery is the process by which the decline of an endangered or threatened species is arrested or reversed, and threats to its survival are neutralized, so that its long-term survival in nature can be ensured. The goal of this process is the maintenance of secure, self-sustaining wild populations of the species with the minimum necessary investment of resources. A self-sustaining population is one that is of sufficient size and genetic diversity to cope with natural habitat fluctuations without the involvement of intensive management. Without an intensive genetics study, it is necessary to operationally define population stability at some subjective level. It is recognized that the population of darters fluctuates naturally and failing to detect a trend in population abundance that is real is often more serious, especially in threatened or endangered species, such as Okaloosa darter. A common problem in detecting trends in population abundance is that variability in the population indices obscure the trends that are occurring in the true population. Therefore, we would use standard deviation metrics to quantify a change over time. The metric described below is intended to determine any declining trends in the status of the population.

The 1.75 standard deviations below the mean was chosen as the threshold level as according to Tchebycheff's inequality equation, at least 67.3 percent of the values will be between 1.75 standard deviations above and below the mean (Brown and Hollander 1977). If the distribution of the number of darters counted at each site is symmetrically distributed, then only 16.3 percent of the observations will be below 1.75 standard deviations of the mean. This level has not occurred in the streams that are being quantitatively surveyed.

A population will be considered stable if (1) Okaloosa darter numbers remain above 1.75 standard deviations below the cumulative long-term average at each of the monitoring sites, (2) the long-term trend in the average counts at each monitoring site is increasing or neutral, and (3) the range that the species inhabits is not decreased by more than a 500-meter stream reach within any of the six stream systems. This operational definition of stability relies on continuing monitoring efforts that are currently being done by U.S. Geological Survey, Biological Resources Division and University of West Florida researchers. A list of monitoring sites, survey techniques, cumulative average number of Okaloosa darters and brown darters, and 1.75 standard deviations below the average, are presented in Table 1.

Biological Resources Division Methods: Twenty-four 20-meter permanent sites in 12 streams are visually surveyed for Okaloosa and

brown darters by snorkeling in the spring and fall. Two transects at each site give a cross section stream profile with stream velocities measured every tenth of the width of the stream. Substrate, submerged vegetation, canopy cover, dissolved oxygen, pH, temperature, turbidity, and conductivity are recorded at each site.

University of West Florida Methods: Fish are collected with a 3.05-m x 1.22-m minnow seine with 3.2-mm mesh at each site for one hour during early spring each year. Okaloosa darters were immediately placed in a clear plastic dish, standard-length measured, and returned to the water within one minute of capture. Water temperature, vegetation, bottom substrate, shore conditions, current speed, and stream depth and width were recorded.

Table 1. Average number of Okaloosa and brown darters observed at sites monitored by the U.S. Geological Survey Biblical Resources Division and University of West Florida.

Stream	Road Crossing	Sampler/ Method*	N	*Etheostoma okaloosae* Mean	STD	Mean-1.75(STD)	*Etheostoma edwini* Mean	STD
Bens Creek	E 619	U / visual	6	15.2	7.0	2.9	0.0	0.0
East Long Cr.	E 192	U / visual	6	2.3	0.8	0.8	5.6	3.2
Juniper Cr.	E 221	U / visual	6	15.6	4.3	8.1	0.0	0.0
Little Rocky Cr.	E 477	U / visual	6	7.8	3.7	1.3	8.3	1.7
Rocky Creek	E 200	U / visual	6	4.9	1.8	1.8	5.7	2.4
West Turkey Cr.	E 232	U / visual	6	23.0	10.7	4.2	0.0	0.0
Rogue Creek	E 233	U / visual	6	37.8	13.5	14.2	0.0	0.0
Tenmile Creek	E 231	U / visual	6	23.5	8.7	8.4	0.0	0.0
Little Rocky Cr.	E 200	U / visual	6	11.1	4.8	2.8	0.6	0.6
Rocky Creek	E 201	U / visual	6	11.7	4.0	4.7	0.0	0.0
West Turkey Cr.	E 637	U / visual	6	29.7	14.1	4.9	0.0	0.0
West Long Cr.	E 406	U / visual	6	12.3	3.8	5.7	0.2	0.4
Toms Cr.	SR 85	M / seine				site to be added in 1998		
Mill Cr.	SR 190	M / seine	12	12.1	13.9	-12.3	0.0	0.0
East Turkey Cr.	Rocky Bayou	M / seine	14	2.1	2.1	-1.6	2.0	2.9
East Turkey Cr.	SR 285	WF / seine	8	10.1	3.1	4.7	0.0	0.0
East Turkey Cr.	E 473	WF / seine	8	27.4	6.6	15.9	0.0	0.0
East Turkey Cr.	Baseline	WF / seine	8	23.5	10.2	5.7	0.0	0.0
Shaw Still Br.	SR 190	WF / seine	8	13.6	10.4	-4.6	0.0	0.0
Swift Cr.	SR 190	WF / seine	8	0.3	0.7	-0.9	32.5	19.8
Swift Cr.	SR 20	WF / seine	8	0.0	0.0	0.0	4.0	3.6
Swift Cr.	SR 285	WF / seine	8	0.0	0.0	0.0	31.4	20.7
Swift Cr.	No #	WF / seine	7	45.9	11.1	26.5	0.0	0.0
Swift Cr.	E railroad	WF / seine	8	19.0	9.2	2.9	0.0	0.0
West Long Cr.	E 406	WF / seine	8	33.5	8.5	18.7	0.0	0.0
West Long Cr.	E 469	WF / seine	8	18.9	11.1	-0.5	0.1	0.3
West Long Cr.	No #	WF / seine	8	5.6	2.2	1.7	0.0	0.0

* Note: All sampler methods are detailed above
U = U.S. Geological Survey, Biological Resources Division and Jacksonville University
WF = University of West Florida
M = Rick Crews, Scott Mettee, University of West Florida, U.S. Geological Survey

APPENDIX B

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The following agencies, organizations, and individuals were mailed copies of this recovery plan. This does not imply that they provided comments or endorsed the contents of this plan. All comments received have been addressed in this final plan. (Reviewers' comments and letters are maintained in the administrative record).

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Environmental Services
8711 Perimeter Park Blvd.
Suite 11
Jacksonville, Florida 32216

Del Lessard
203 West John Sims Parkway
Suite 2
Niceville, Florida 32578

ATTACHMENT D

PUBLIC REVIEW

Public Notification

In compliance with the National Environmental Policy Act, Eglin Air Force Base announces the availability of the Draft Environmental Assessment and the Finding of No Significant Impact and Finding of No Practicable Alternative for the Mill Creek Restoration Project on the Eglin Air Force Base, Florida, golf course, for public review and comment.

The Proposed Action is to re-design segments of Mill Creek that run through portions of the Falcon golf course. The U.S. Fish and Wildlife Service approved alterations to Falcon holes 2, 16, and 17 which include removing the buried culverts, replacing them with free-flowing streams, and installing bridges to allow cart and foot traffic. Native vegetation would be planted in the resulting streambeds. The culvert at hole 14 would be replaced with a new culvert with different intake and outflow points. The action is expected to take six to eight weeks to accomplish. Due to the scheduled closing of the Eagle course from April-September 2007 and darter spawning season in March-April, the project must begin no later than 1 Jan 2007.

Your comments on this Draft Environmental Assessment are requested. Letters or other written or oral comments provided may be published in the Final EA. As required by law, comments will be addressed in the Final EA and made available to the public. Any personal information provided will be used only to identify your desire to make a statement during the public comment period or to fulfill requests for copies of the final EA or associated documents. Private addresses will be compiled to develop a mailing list for those requesting copies of the Final EA. However, only the names and respective comments of respondent individuals will be disclosed. Personal home addresses and phone numbers will not be published in the Final EA.

Copies of the Mill Creek Restoration Project may be reviewed at the Fort Walton Public Library, Niceville Library, and Crestview Public Library from July 17 through August 30, 2006. Comments must be received by September 1, 2006.

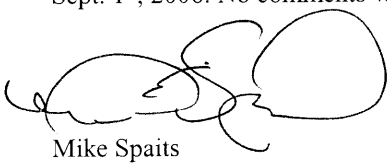
For more information or to comment on these proposed actions, contact:
Mr. Mike Spaits, 96 CEG/CEV-PA, 501 De Leon Street, Suite 101, Eglin AFB, Florida 32542-5133 or email: mike.spaits@eglin.af.mil

NW FL DAILY NEWS, 17 JUL 06, pC7

Response to Comments for RCS 06-256
Mill Creek Restoration Project Environmental Assessment

A public notice was published in the *Northwest Florida Daily News* on Jul. 17 to disclose completion of the Draft EA, selection of the preferred alternative, and request for comments during the 45-day pre-decisional comment period.

The 45-day comment period ended on Aug. 30th, with the comments required to this office not later than Sept. 1st, 2006. No comments were received during this period.



Mike Spaits
Public Information Specialist